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FACTORY

MANAGEMENT and MAINTENANCE

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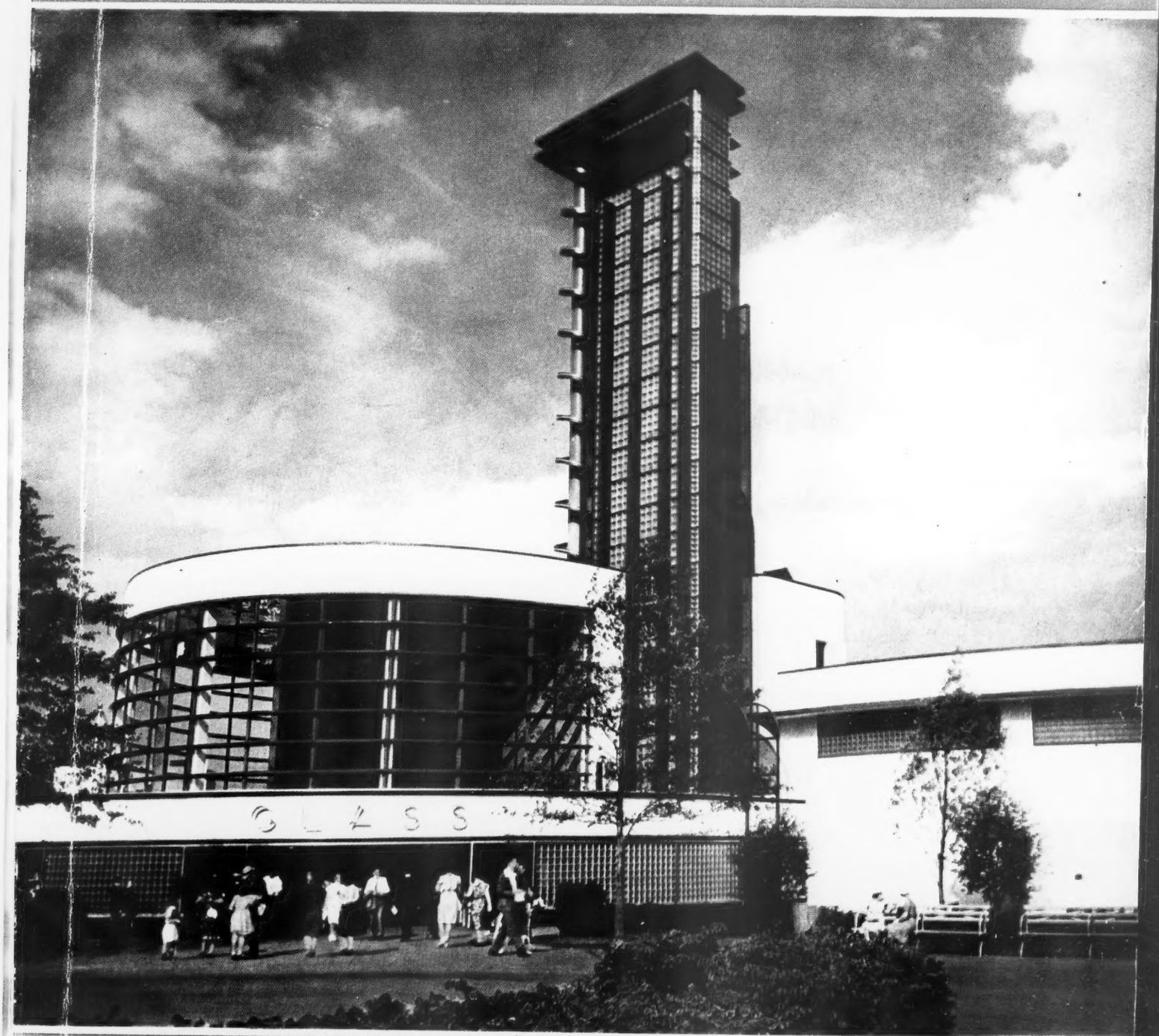

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Fourteenth Annual Special Section **MATERIALS-HANDLING**

CALL THE ROLL OF AMERICAN INDUSTRIES

WARRANTED
The Simonds Saw
U.S.A.
SIMONDS SAW AND STEEL CO.
ESTAB. 1832
UNEQUALED IN QUALITY AND UNIFORMITY
STEEL MILL FACTORIES
LOCKPORT, NEW YORK.
FITCHBURG, MASS. CHICAGO, ILL.

IN 7 CORROSIVE SERVICES
SIMONDS SAW & STEEL CO. USES

BYERS WROUGHT IRON

In the new "windowless factory" of the pioneer saw manufacturer, Simonds Saw and Steel Co., designers used every modern device that would increase efficiency, safety, comfort and economy . . . but they found no "modern" substitute for time-tried wrought iron in corrosive piping services. Byers Wrought Iron was used for the 6" oil supply lines to underground oil storage tanks; 2" oil pressure lines from storage to quenching tanks; air lines to storage tanks; underground steam and return lines; all water supply lines; and underground electrical conduit.

The quenching oil is vegetable base, and of secret composition. In handling this unique material, wrought iron again demonstrates its versatility in combating a great variety of corrosive conditions.

The chances are that somewhere in your plant or equipment corrosion is costing *you* more than wrought iron . . . and that Byers can save you money and trouble. If you will write, outlining the particular problem, our Engineering Service Department will (1) Determine the probable corrosive conditions; (2) Relate these to equivalent conditions encountered elsewhere; (3) Interpret the results, in the light of 75 years' contact with corrosion problems, and (4) Make recommendations . . . supported by service records. Ask for a complimentary copy of our bulletin, "Wrought Iron for Piping Systems."

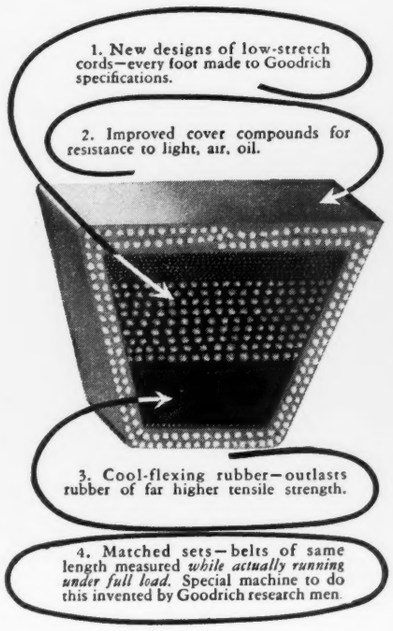
A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

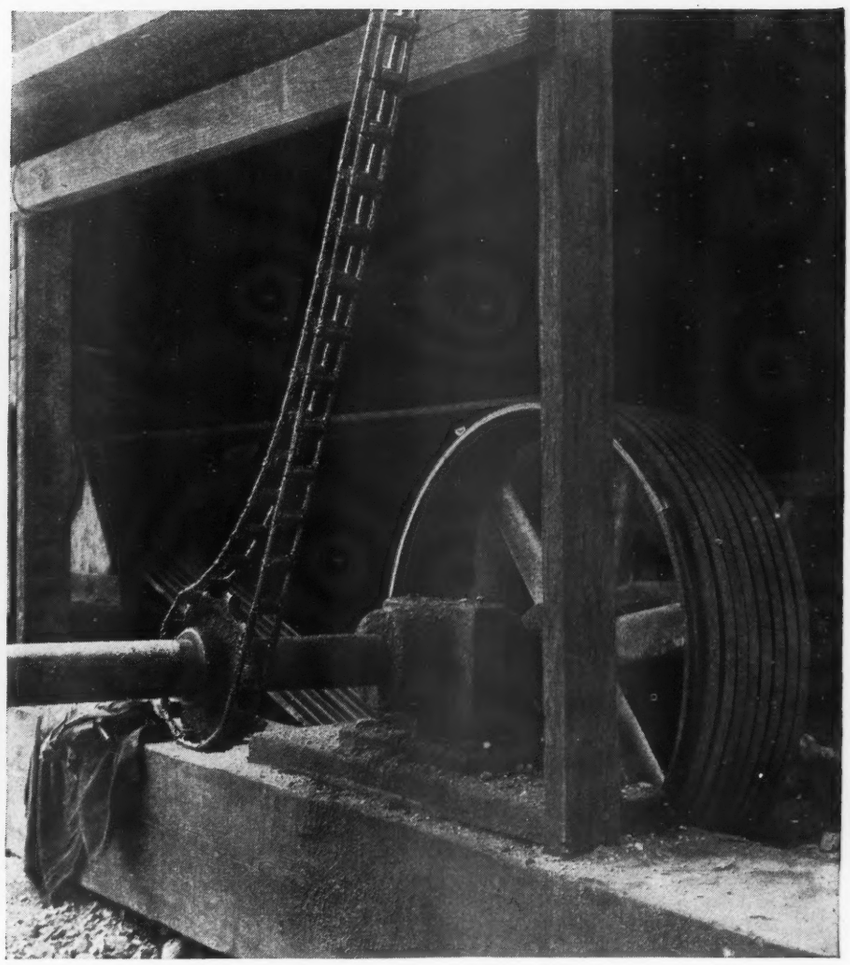
BYERS GENUINE WROUGHT IRON

TUBULAR AND FLAT ROLLED PRODUCTS

Specify Byers Genuine Wrought Iron Pipe for corrosive services and Byers Steel Pipe for your other requirements

Recent Improvements in Goodrich V-Belt


1. New designs of low-stretch cords—every foot made to Goodrich specifications.
2. Improved cover compounds for resistance to light, air, oil.
3. Cool-flexing rubber—outlasts rubber of far higher tensile strength.
4. Matched sets—belts of same length measured *while actually running under full load.* Special machine to do this invented by Goodrich research men.



5 years in industrial "Dust Bowl"

prove time-and-money-saving values of Goodrich V-Belts

EVEN in the clouds of gritty, cutting dust under this quarry crusher, Goodrich V-Belts have stood up for five years of gruelling use—because of their special construction improvements which can save time and money for you, too.

Goodrich V-Belts are made with a tough cover of rubber-impregnated fabric which prevents ply separation by protecting the belt from dust, moisture, fumes, oil.

Goodrich V-Belts are available in *matched sets*—each belt tested and measured under *actual operating tension,* and a set then made up only of those belts which will operate together as a good team should. Belts in ordinary sets develop unequal lengths in use, the longer belts then idle and slip, and wear out too soon. In Goodrich matched sets each belt pulls its full share, and the set wears evenly, lasts far longer.

Goodrich Research Makes Other Improvements

In addition to protective covers and matched sets, Goodrich V-Belts have other improvements, developed by Goodrich research, which increase belt life, reduce belt cost and trouble. One important value is a special cool-running rubber which reduces internal belt heat by 75%. The heat of flexing is what destroys belts as it does tires. Just as tire life has been multiplied in recent years, Goodrich V-Belt life is now far longer than the life of belts you may have known even a few years ago.

Other developments of Goodrich research are low-stretch cords which reduce slippage, and Goodrich Age-Rite compound which resists oxidation or attack by air.

Goodrich Belts Available Quickly

When you can have the lower cost, the greater freedom from trouble and production shutdowns which Goodrich V-Belts assure you, why stick to belts which do not offer you these advantages? There are 60 distributing points for Goodrich V-Belts—one near you. Call your Goodrich Distributor—and start saving money, time and trouble. The B. F. Goodrich Company, Mechanical Rubber Goods Division, Akron, Ohio.

Other typical Performance Reports of Goodrich V-Belts

▼

On dredge in cement-products plant, Goodrich V-Belts are still in use after 8 years.

▼

Steam turbine drive had ruined former belts in less than a month. Goodrich V-Belts have lasted 14 months and are still good.

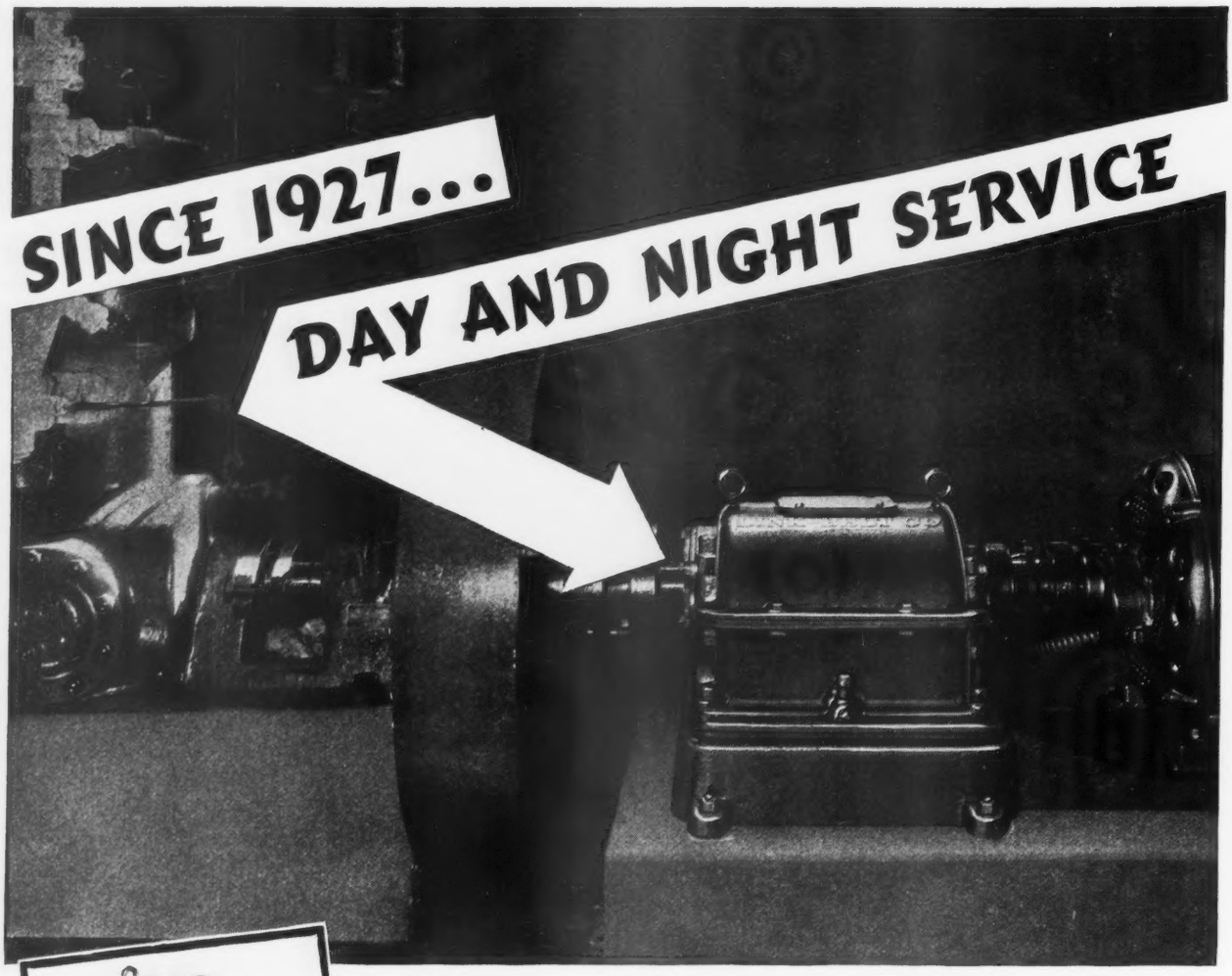
▼

The terrific shock load in a "pole peeler" broke belt after belt instantly. Goodrich V-Belts were tried and are still in operation—the buyer now will use no other brand.

Goodrich

cool-running, tension-matched

V-Belts



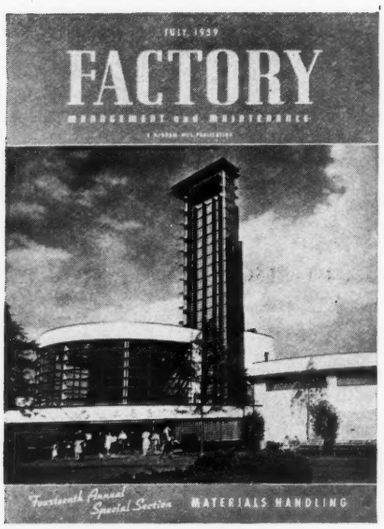
Motorized Helical Gear Reducer
Worm Gear Reducer
OTHER LINK-BELT POSITIVE DRIVES INCLUDE:
Silverlink Roller Chain Drive
Silverstreak Silent Chain Drive
P.I.V. Gear and V.R.D. Variable Speed Units

and not a cent for repairs or maintenance!

● The herringbone gear speed reducer, illustrated, is operating an ammonia compressor where it has been in constant service practically 24 hours a day for 12 years. It has proved beyond question the exceptional dependability that is built into Link-Belt speed reducers. If you want a reducer that will give years of trouble-free service—one that is precision-built for dependable performance—and one that will cost you practically nothing for maintenance, be sure to investigate the Link-Belt line. Besides herringbone gear reducers, Link-Belt also offers worm gear and motorized helical gear units in a variety of sizes, ratios and horse powers to meet practically any requirement.

Send for catalogs on any or all of the Link-Belt positive drive units illustrated. Address: Link-Belt Company, Philadelphia, Chicago, Indianapolis, Atlanta, San Francisco, Toronto, or any of our other offices, located in principal cities. 7772

LINK-BELT
SPEED REDUCERS



WHAT WILL FACTORIES look like in the world of tomorrow, plant operators wonder. Possibly in the spectacular new Johnson Wax building (see page 96) we have a presage of the future, or perhaps the Glass Center Building at the New York World's Fair, FACTORY's cover subject this month, more nearly approximates the lines of development. Whether it be one or the other, or some third type yet unveiled, it is certain to facilitate economical production and be a pleasant place to work in. A McGraw-Hill staff photographer made the four-color cover photograph.

•

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FACTORY

MANAGEMENT and MAINTENANCE

JULY, 1939

Public Relations and Industrial Relations Are Siamese Twins — *L. C. Morrow* 37

Management's Job—As I See It — *Charles R. Hook* 38

48 Weeks at 40-Hour Pay — *Charles P. McCormick* 40

Better Products at Lower Prices for More People 42

Now Their Neighbors Know Them — *Lewis K. Urquhart* 44

Controlling Work in Process — *J. J. Colbert and B. A. Moski, Jr.* 46

The ABC's of Personnel — *Charles S. Stevenson* 48

How to Convert Projectors for Motion Study — *David B. Porter and Louis P. Granath* 49

Management Shorts 51

Let's Hear How Maintenance Cuts Costs...New Layouts May Call for Changes in Lighting . . . Don't Store Equipment That Should Be Junked — *editorials* 78

They Make Machines Fit the Motors — *Arthur Van Vlissingen* 79

Six Ways to Save on Power Bills — *L. D. Cleverly* 82

Vibration Isolators Hush These Machines 84

Effective Maintenance Works WITH Production — *John I. Thompson* 86

Quicker Drying with Lamps — *E. W. Beggs* 88

Sales Set This Maintenance Budget — *John Beall* 90

They Profit by Good Lighting 92

Couldn't Run Without Instruments — *John C. Kuhns* 94

Is This the Plant of Tomorrow? — *J. F. Andrews* 96

Maintenance Service Shorts 97

Motor Troubles—Symptoms, Causes, Remedies . . . *data sheets* 99

You Want to Know 102

What's New in Equipment 104

Trade Literature 140

Books 148

Calendar 148

and

Factory's 14th Annual Special Section on

Materials Handling 53

GULF RESEARCH TECHNOLOGISTS create lubricants with greater stability

Higher resistance to decomposition proved by tests with specially designed laboratory apparatus which duplicates actual service conditions

With the experimental equipment shown above (designed and built in the Gulf laboratory) lubricants are tested under a wider range of operating conditions than are encountered in actual service. The facts developed are useful to Gulf technologists in perfecting lubricants which not only meet specific operating conditions but provide an *extra margin of safety.*

YOUR modern machinery represents a big investment. You want to preserve your costly machines, keep them operating at a profit.

Then pay particular attention to their lubrication. Make sure their moving parts are protected with lubricants which provide an *extra margin of operating safety.*

You can get that kind of protection by standardizing on Gulf's higher quality lubricants! For they have undergone special laboratory tests which have proved their endurance and resistance to decomposition when subjected to far more severe operating conditions than are encountered in your equipment.

Working closely with machinery builders, Gulf research men have developed modern types of lubricants which are helping plant operators meet today's demands for higher standards of efficiency. By reducing friction and wear to an absolute minimum, these better lubricants help you save money on maintenance and power, improve both quality and quantity of production and lengthen the life of your fine precision machines.

If you want the kind of lubrication that costs you least in the long run, ask a Gulf engineer to make a careful check of your equipment and recommend the proper application of oils and greases exactly suited to each moving part. This service is offered to every industrial, marine and utility operator from Maine to Texas. These better oils and greases are quickly available to you through more than 1100 Gulf warehouses located at principal distributing points . . . Gulf Oil Corporation — Gulf Refining Company, Pittsburgh, Pennsylvania.

ALSO, A COMPLETE LINE OF FUEL AND FURNACE OILS

5 BRIEF CASES

...For electrical buyers who want EXTRA VALUES

SAVINGS ON WAREHOUSING
You can save the cost of maintaining heavy reserve stocks by letting a nearby, well-stocked Graybar warehouse take the place of your own stockroom. You save time and trouble by ordering *everything electrical* through one source.
NO DELAY!
When you need something in a hurry, Graybar's speedy "action service" rushes you the items you need by fast truck delivery. By bringing you needed items promptly, Graybar can help you save by cutting down production losses due to shut-down machinery.
MEN WHO KNOW YOUR NEEDS
They can help you with electrical problems. The average experience of Graybar managers, service managers, and supply department managers is 24.13 years. You put their years of experience to work for you, when you deal with Graybar.
DEPENDABLE PRODUCTS
... the key to efficient maintenance. You can depend on products from Graybar... the products of 200 leading electrical manufacturers. Behind every product stands Graybar's guarantee ...and Graybar's 70 year reputation.
IN 1869 GRAY & BARTON
70th ANNIVERSARY
Graybar
ELECTRIC COMPANY
IN 1939 GRAYBAR

OFFICES IN 83 PRINCIPAL CITIES. EXECUTIVE OFFICES: GRAYBAR BUILDING, NEW YORK, N. Y.

Announcing the 1939

MACHINE TOOL SHOW

THE GREATEST EXHIBIT OF THE TOOLS OF INDUSTRY EVER PRESENTED

Cleveland

OCTOBER 4-13, 1939

NATIONAL MACHINE TOOL BUILDERS' ASSOCIATION

10525 CARNEGIE AVENUE, CLEVELAND, OHIO

EXHIBITS

The 195 exhibits, occupying 150,000 square feet of floor space, will display nearly 1,000 machines. These will include every type of machine tool in its most modern form, and in full operation . . . also many types of allied equipment and accessories. Every facility will be afforded visitors for careful, thorough inspection.

MACHINE TOOL CONGRESS

A Machine Tool Congress, sponsored by the professional engineering societies, will be held in evening sessions during the period of the Show. Foremost authorities will speak at the forum meetings of this Congress, on important developments in manufacturing methods.

ATTENDANCE

Attendance will be limited to qualified visitors. Admission to the Machine Tool Show will be by registration only. Among those attending will be officers and directors of manufacturing companies, operating executives, engineers, production men, buyers. More than 50,000 people visited the Machine Tool Show of 1935.

YOUR SMARTEST INVESTMENT TODAY . . . MODERN MACHINE TOOLS

A DULL TOOL STOPS HIM

A "DULL" BRUSH SLOWS HIM

How many wage dollars are wasted in YOUR plant by workers handicapped with worn brushes?

● "Whew-w-w!" says the chap trying to work with a worn hacksaw blade. His muscles tell him he's wasting time. So he loses no time in getting a good saw.

It's the same with most tools, *excepting BRUSHES.* Many a worker *unknowingly* wastes time working with either a badly worn or inferior brush.

WHY? Probably because *it's just as easy to waste time with a poor brush as it is to SAVE TIME WITH A GOOD BRUSH!*

All OSBORN BRUSHES (and that includes STANDARD Osborn Brushes) are ENGINEERED TO THEIR JOBS.

That makes Osborn Brushes work better, last longer, SAVE TIME and CUT COSTS!

Put Osborn Brushes to work for YOU. Osborn and the Osborn Distributor near you can help. *Ask about it.*

THE OSBORN MANUFACTURING COMPANY

5401 HAMILTON AVENUE • CLEVELAND, OHIO

Sales Offices: New York • Detroit • Chicago • San Francisco

OSBORN Osborn Brushes

THE OSBORN MANUFACTURING COMPANY • 5401 HAMILTON AVENUE • CLEVELAND, OHIO

A story about

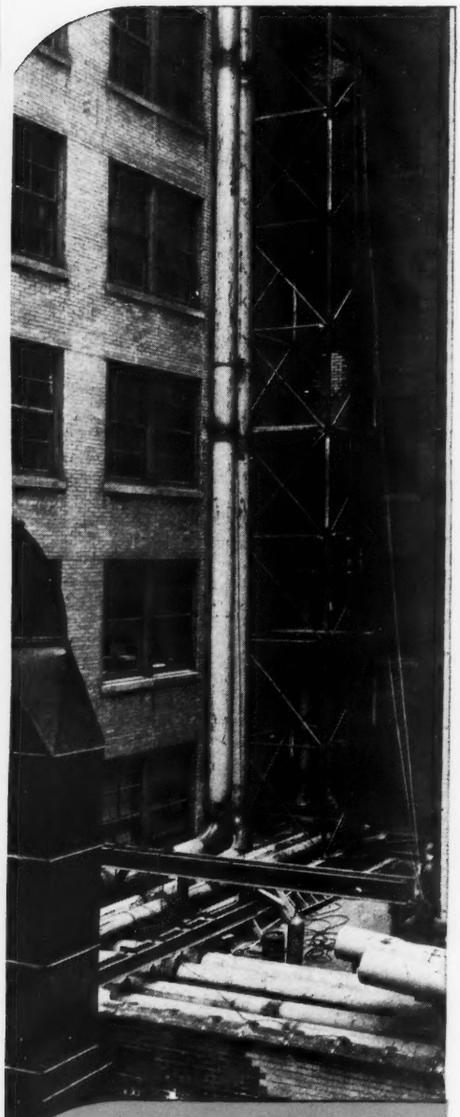
TONCAN IRON

An alloy of refined open-hearth iron, copper and molybdenum—*that grows old slowly*

AVAILABLE IN . . . BLACK, GALVANIZED and GALVANNEALED SHEETS • CULVERTS • BLACK and GALVANIZED PIPE • CONDUIT GROUND RODS • WELL STRAINERS • PLATES • WIRE and WELDING ROD • NUTS—BOLTS—RIVETS • BARS • SECTIONAL PLATE PIPE ROOFING, GUTTERS and DOWNSPOUTS • TUBING • CASING

REPUBLIC STEEL PRODUCTS OF INTEREST TO INDUSTRY INCLUDE:

THIRTEEN STORIES



Telling what one company did to make each story more habitable by air-conditioning, in which Toncan Iron plays a leading part.

It was a 25-year-old office building located in a city where summers were none too cool. Being staunchly built, the owners decided to make it more comfortable for the employees and installed the largest air-conditioning system ever engineered into an old building.

Toncan Iron Pipe in sizes up to 16-inch and Toncan Iron Sheets—11 carloads in all—carry the cooling water and air to every part of this 13-story building.

Toncan Iron was selected because of its uniform high resistance to rust—its weldability—the ease with which sheets fabricate into ducts, its economy based on scores of records of unusually long life in service of every type where this copper molybdenum open-hearth iron has been used.

There's a place in every plant and every office building, projected or old enough for modernizing, where the staying powers of this alloy material will save money for the owner. Let us send you TONCAN IRON literature showing service records that will prove the point.

REG. U. S. PAT. OFF.
REPUBLIC
STEEL

* REG. U. S. PAT. OFF.

REPUBLIC STEEL CORPORATION
GENERAL OFFICES • CLEVELAND, OHIO

UNION DRAWN STEEL DIVISION • TRUSCON STEEL COMPANY
BERGER MANUFACTURING DIVISION • STEEL AND TUBES, INC.
NILES STEEL PRODUCTS DIVISION

STEEL, COPPER BEARING STEEL, ENDURO* STAINLESS STEEL AND RUST-RESISTING TONCAN IRON—SHEETS, STRIP, PLATES, BARS, PIPE, TUBING, WIRE, BOLTS, NUTS, RIVETS AND WELDING ROD

AVOIDING "TROUBLE"

Save Cost

THE SUM OF THESE FOUR SAVINGS

1. REDUCED POWER CONSUMPTION
2. MORE CONTINUOUS PRODUCTION
3. DECREASED MAINTENANCE
4. LOWER LUBRICATION COSTS

4 = LUBRICATION PROFIT

EXECUTIVES who are probing costs soon find that "trouble-free" operation is not enough. Machines that seem to be running smoothly...

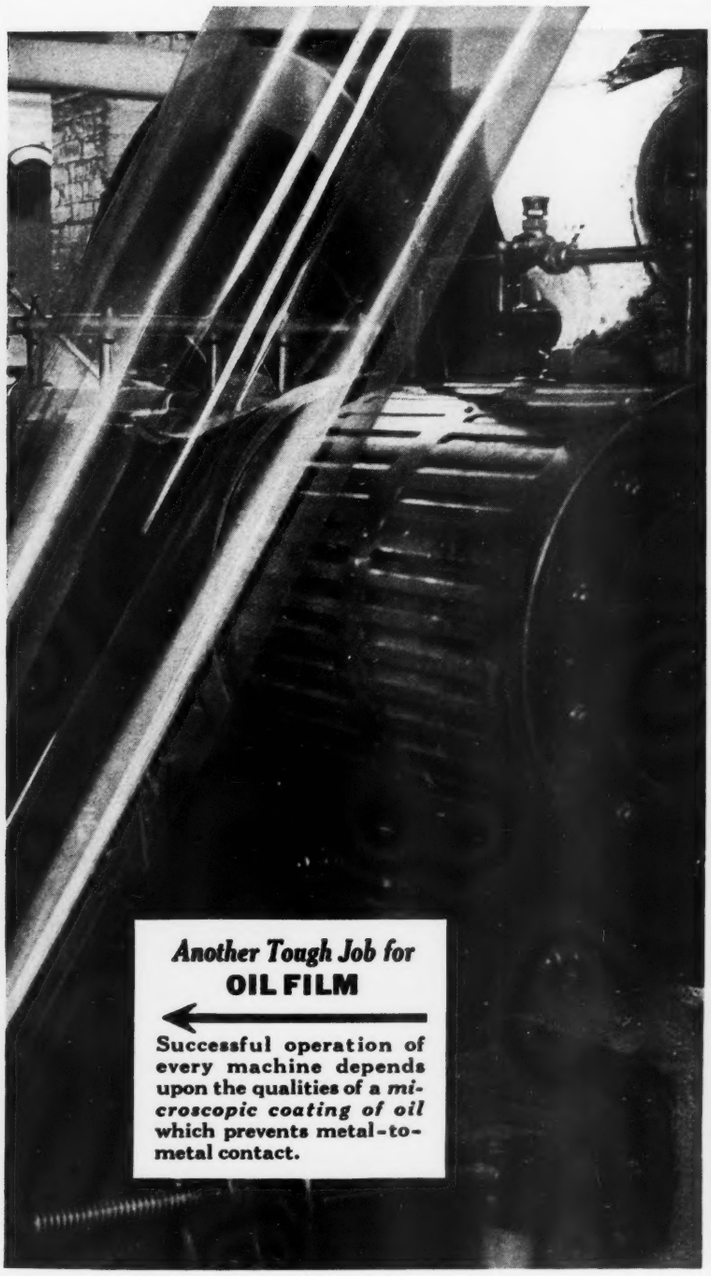
—may be slowing up production, requiring too much power, too much oil, and even too much maintenance!

These are profit leaks the Socony-Vacuum man is trained to ferret out. His backing of 73 years' experience enables him to give sound engineering advice in effecting economies, and to recommend Gargoyle Lubricants exactly right for every use.

In thousands of plants, the Socony-Vacuum man's visit has not only resulted in "trouble-free" operation —but a substantial Lubrication Profit as well!

ISN'T ENOUGH...

ts 4 Ways!



Another Tough Job for
OIL FILM

Successful operation of every machine depends upon the qualities of a *microscopic coating of oil* which prevents metal-to-metal contact.

SOCONY-VACUUM

Industrial Service and Lubricants Help to Lower Costs by

Correct Lubrication

GARGOYLE Lubricants

SOCONY-VACUUM OIL CO., INC.

Standard Oil of New York Division · White Star Division
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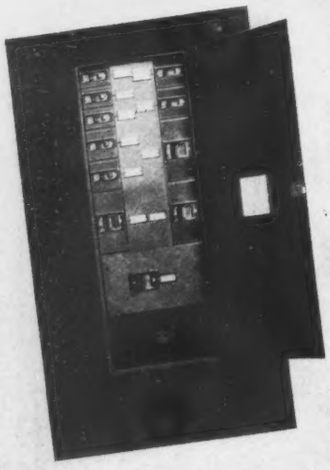
MODERN EQUIPMENT PAYS ITS OWN WAY!

SAVE MAINTENANCE—OUTAGE LOSSES—AND FUSE REPLACEMENTS—WITH NOFUZE EQUIPMENT

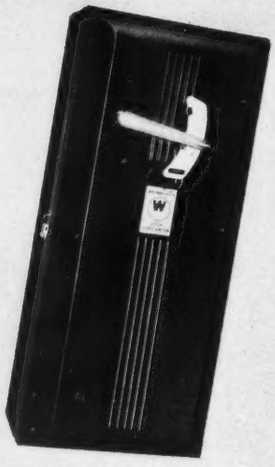


NOFUZE POWER PANELBOARD

Save on circuit protection: Nofuze equipment pays dividends year after year—eliminating delays due to unnecessary circuit interruptions, saving annoyance, time, inconvenience incidental to replacing fuses.

NOFUZE CIRCUIT BREAKER

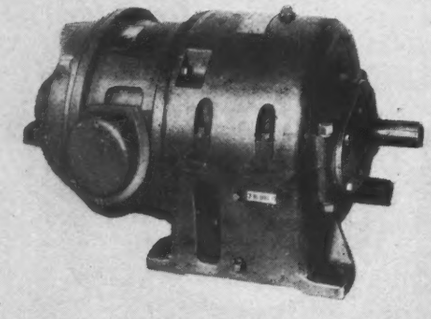
Save on production time: Nofuze breakers for individual motor circuits save losses of idle men and machines due to fuse outages. Many factories have found this small investment pays for itself in two or three months.



NOFUZE COMBINATION LINESTARTER

Save on motor repairs: This compact unit combines Nofuze circuit protection with the famous "De-ion" Linestarter. Protects the circuits, starts, stops, and protects the motor from overload or under-voltages.

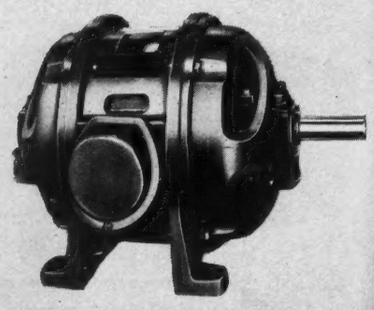
SAVE ON MAINTENANCE COST—AND CUT YOUR POWER BILLS WITH WESTINGHOUSE MOTORS



GEARMOTOR

Save installation and maintenance costs: Get 96% to 98% of high speed motor efficiency for your slow speed drives with Westinghouse Gearmotors. Simply specify the required horsepower and the necessary shaft speed of the driven machine. Save in installation and maintenance cost.

Save motor "grief": Westinghouse motor construction eliminates grief from overlubrication of ball bearings . . . overflow sump prevents damage to windings from excess grease in ball bearing equipment. On sleeve bearings the exclusive seals keep lubricant in, bar out dust, dirt and grit.



GENERAL PURPOSE MOTOR

Westinghouse

W
WESTINGHOUSE ELECTRIC

$70 + $1440 + $191 = $1701 saved on just 3 Machines

A PROMINENT PAPER MANUFACTURER found that blown fuses and motor burnouts were causing production to drag—and costing too much loss in man-hours, machine time and maintenance expense. By replacing fuses with Westinghouse Nofuze protection, on just three machines, they saved a total of $1701 a year... and here's the way they did it:

$70 HERE

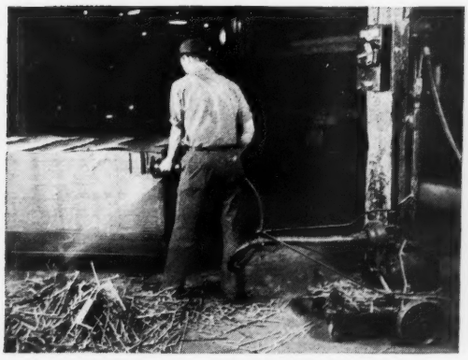
Every day, 3 or 4 fuses blew, 15 minutes lost each time, for 3 operators and 3 machines. Cost of lost man-hours alone — $1.35 per day — $70 per year, plus idle machine time. One ABI Breaker reduced it to estimated five minutes loss per day, with no maintenance.

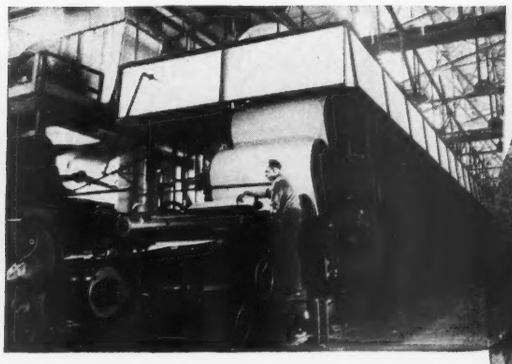
$1,440 HERE

Any one of six motors burning out on this paper machine caused loss of $125 per hour machine time, plus $100 motor repair. Four times a year — the usual record — cost $1,440. All saved with Nofuze Breakers — not a motor burnout in 2½ years.

$191 HERE

The vertical pump motor used to circulate material through the sump frequently stalled due to overload. Workmen blocked the fuses, tried to force impeller with large wrench. Frequent result — burnt-out motor. Even at once a year, this cost $191 for repairs. But a Westinghouse Nofuze Combination Linestarter stopped the trouble and cost — permanently.



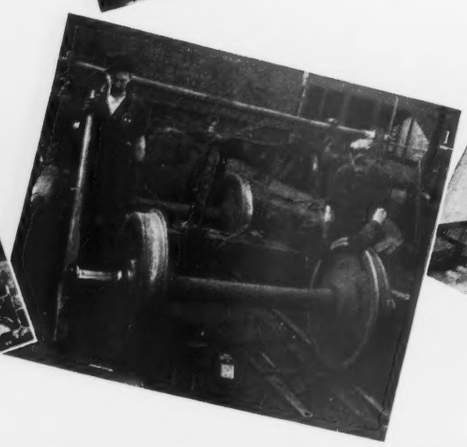


Perhaps you could make similar savings, speed up operations, improve products, with modern electric drives. Westinghouse will help you check your plant. Just call the local office, or write Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Address Dept. 7-N.

J-90204

Motors and Control

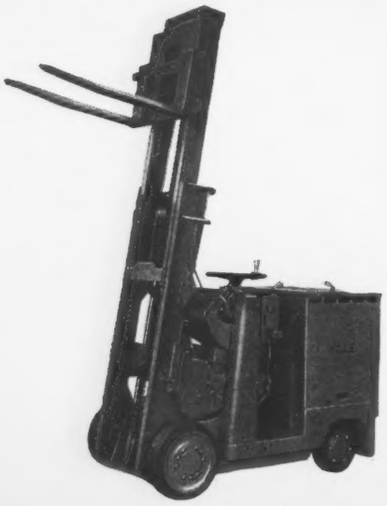
YALE MATERIALS HANDLING

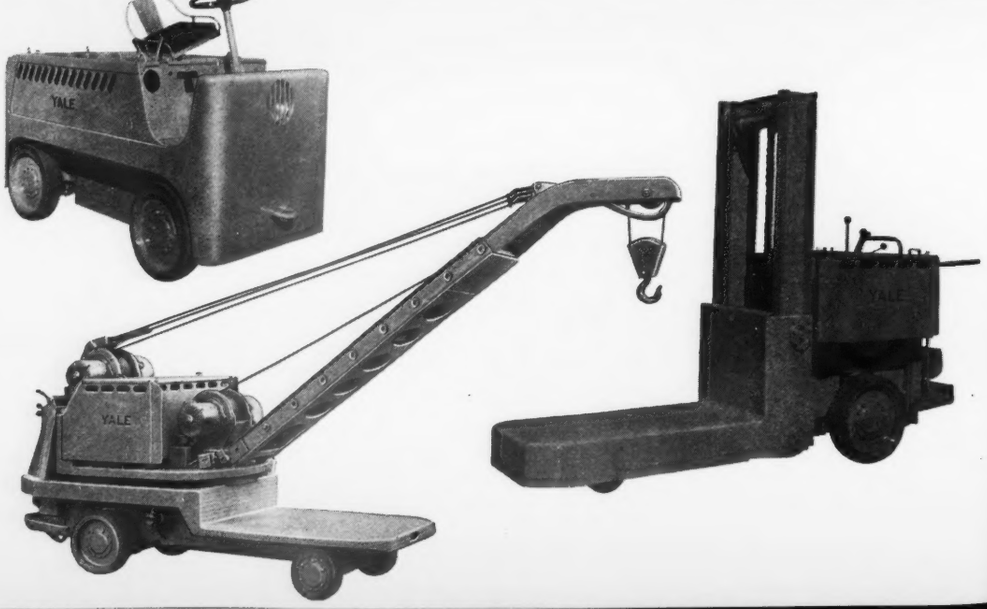


Because we specialize in the design, construction and application of materials handling equipment that handles goods safer, faster and more economically—we have served and saved for the world's largest industries. We are equipped to do the same for you.

TRADE **YALE** MARK

THE YALE AND TOWNE MANUFACTURING CO.



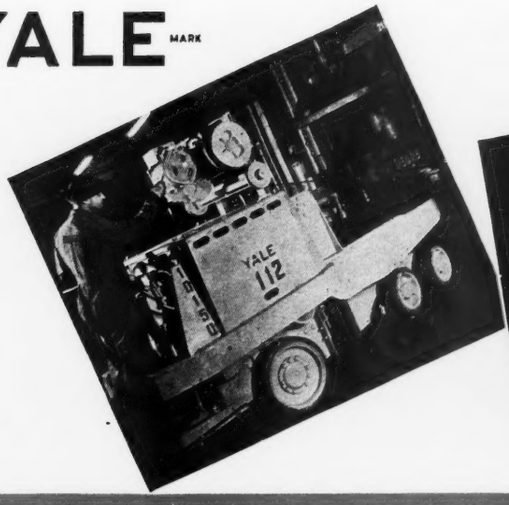


EQUIPMENT WILL CUT COSTS FOR YOU!

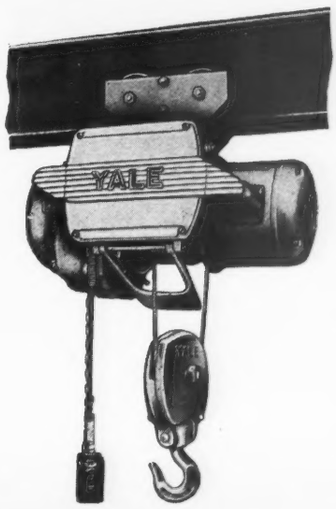
Trained sales engineers are located in 56 major industrial centers ready for instant service. Consult your classified directory.

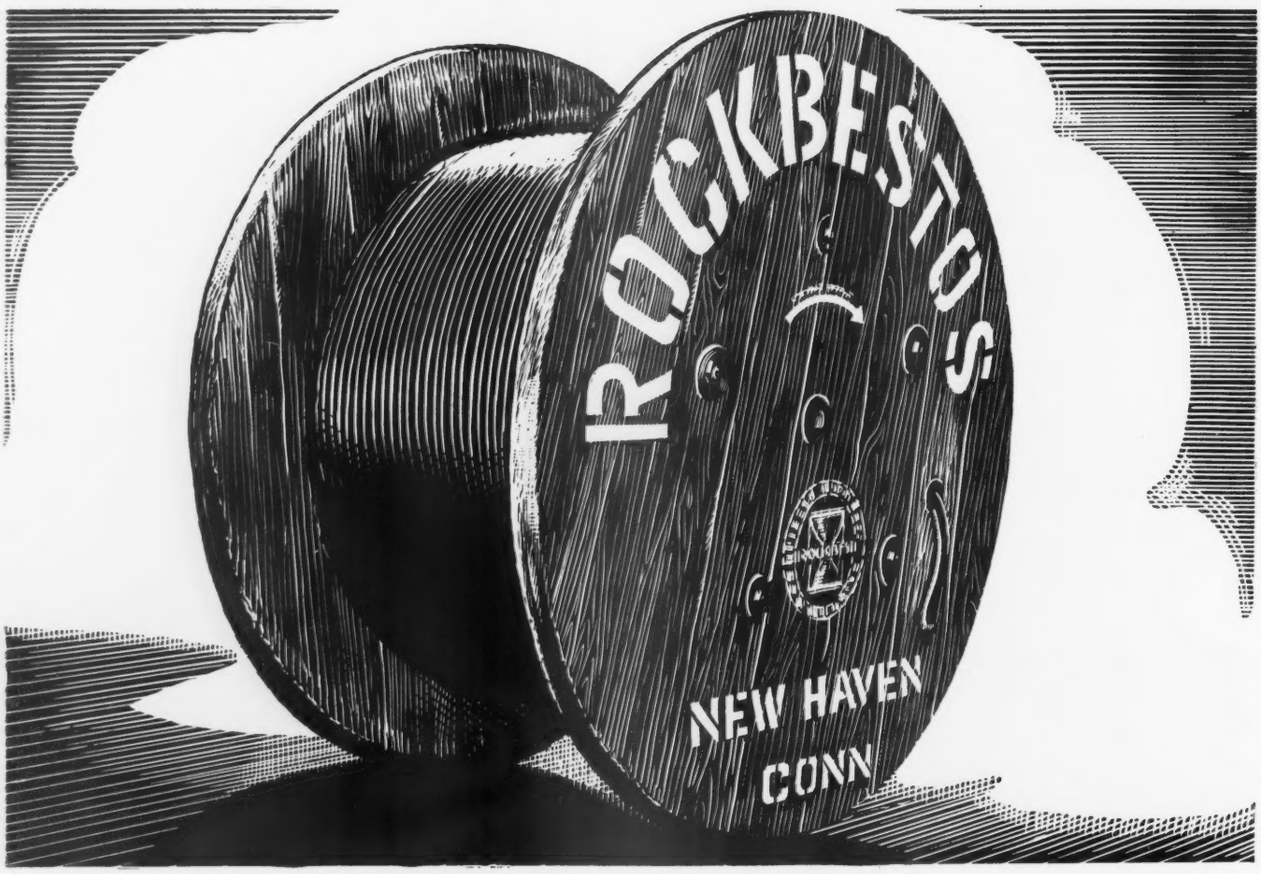
ELECTRIC INDUSTRIAL TRUCKS
HAND LIFT TRUCKS
SKID PLATFORMS
ROLLAWAY JACKS
HAND CHAIN HOISTS
ELECTRIC HOISTS
CABLE HOISTS
TROLLEYS

TRADE **YALE** MARK



PHILADELPHIA DIVISION–PHILADELPHIA, PA.





MEET OUR *Best* SALESMAN

Perhaps a Rockbestos wiring engineer has called on you, left a catalog, asked if you had any circuits which habitually kick up trouble, made recommendations, offered to send samples, etc. Possibly he convinced you that he was a capable trouble shooter and that Rockbestos has made a specialty of designing and producing wires and cables for severe conditions . . . but . . . unless you placed a trial order for some of our wire you haven't met our best salesman.

It's the old story of the proof of the pudding. Use Rockbestos in a circuit which has always required replacement at periodic intervals because of heat, oil, grease, corrosive fumes or some other insulation destroying condition, compare performance, and we guarantee that you'll be sold on it as an economical trouble eliminator. Our sales records contain the names of thousands of industrial concerns in which this procedure has been duplicated. The fact that they have consistently bought more and more Rockbestos proves our contention.

For confirmation write for the names of Rockbestos users in your locality. For positive proof place a trial order and satisfy yourself that the "TEN TESTED ROCKBESTOS VALUES" will reduce your maintenance expense. For a catalog or samples write to Rockbestos Products Corporation, 926 Nicoll St., New Haven, Conn.

TEN TESTED ROCKBESTOS VALUES

1. Heatproof
2. Fireproof
3. Permanent
4. Lower maintenance cost
5. Resists heat and vibration
6. Saves work
7. Oil and Greaseproof
8. High overload capacity
9. Permanently flexible
10. Greater carrying capacity

Also refer to Electrical World Buyer's Reference

THEY GO 'ROUND AND 'ROUND TOGETHER!

There's No Sag, No Slip, No Uneven Wearing When You Use MATCHED SETS of Allis-Chalmers Texrope V-Belts! Read How They Can Help You Cut Your Power Transmission and Maintenance Costs!

NEW MEASURING MACHINE SHOWS EXACT length of belt to 1/100th of an inch . . . permits matching of belts into sets that carry the load TOGETHER!

There's a special reason why Allis-Chalmers Texrope V-Belts do their share of work equally, carrying the load TOGETHER! It's because they are sold in *matched sets!*

And matching Texrope belts is more than just taking units from the same mould or production run. Now — with a newly developed measuring machine — every belt is tested in a grooved sheave running under normal operating tension . . . and the exact length to 1/100 of an inch is registered on a finely calibrated meter.

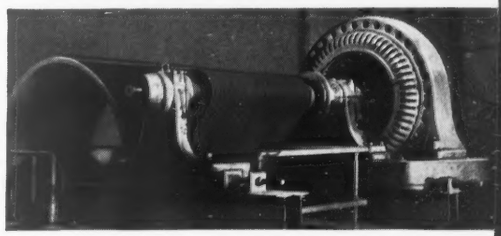
That's the kind of accuracy you want in the belts you buy for your plant. It means long, even wearing . . . and a transmission efficiency up to 98.9%!

Originally developed by Allis-Chalmers, Texrope multiple V-Belts are everywhere helping plant operators to cut costs. With these drives, there is no slipping . . . no jerking . . . no roar or hum. Production is made steady . . . maintenance costs on motors and drives are sharply reduced!

Cut Costs With Texropes!

Get in stride with the times . . . follow the lead of others who every day are cutting costs with Texropes. Learn how you can save in your plant with long-wearing Texrope Drives in *matched sets!*

There's a trained engineer in the district office near you who is backed by Allis-Chalmers 90 years of experience. He'll be glad to explain Texrope features . . . to show you how you can cut your power transmission costs. Call him today. Or write direct to Allis-Chalmers.



ALTHOUGH DRIVEN BY A 90 RPM diesel engine with extremely severe power impulses, the thirty six belts on this generator act as a unit, sharing the load equally . . . because they are matched as a set!

Vari-Pitch Speed Changers • Texrope V-Belts • Duro-Brace Texsteel Sheaves • Vari-Pitch Sheaves • Standard Cast Iron Sheaves • Adjustable Pitch Diameter Texsteel Sheaves • 2-3-4 Combination Sheaves • Straitline Automatic Motor Bases • Oil Field Drilling Rigs

Belts by Goodrich

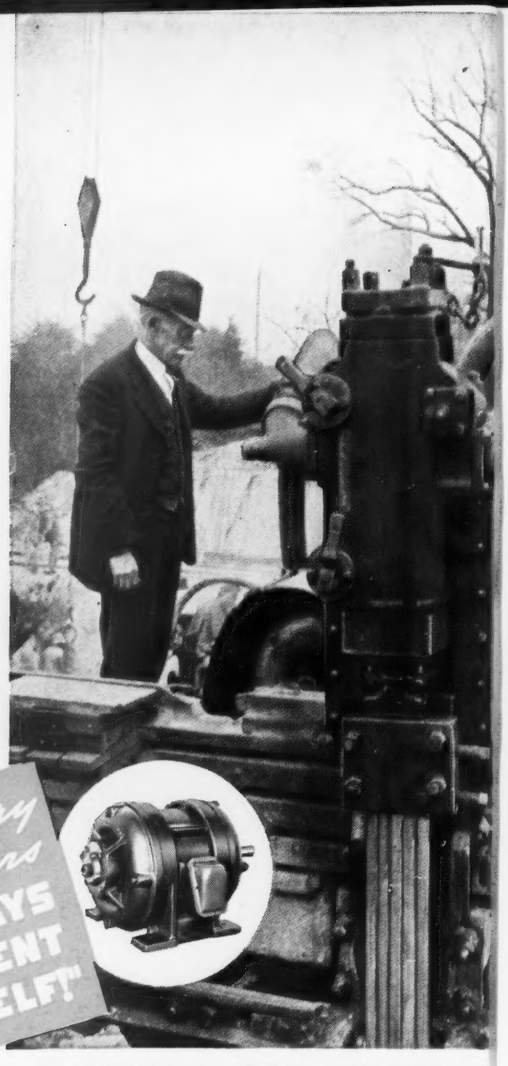
TEXROPE DIVISION

ALLIS-CHALMERS

MILWAUKEE · WISCONSIN

1092

THIS JOB "KILLED" MOTORS!



A. W. HAMILTON, CHIEF ELECTRIcian of Alberene Stone Corporation, inspects the Lo-Maintenance Motor on one of his channeling machines. Insert shows a closeup of the Lo-Maintenance Motor that stayed on the job under conditions that "killed" other motors.

Another true case history from the Allis-Chalmers files that proves **"IT PAYS TO BUY THE EQUIPMENT THAT PAYS FOR ITSELF!"**

Lo-Maintenance Motors Set Impressive Performance Record on Job that Wrecked Ordinary Motors! Find Out How Full Measure Construction in Lo-Maintenance Motors Means "Full Time" on the Job with No Frequent Time-Outs for Repairs!

"The Motor-Killing Job"—that's what they called it at the Alberene Stone Corp., Virginia! And they weren't far wrong! For the motors on their machines that channeled serpentine stone took a terrific pounding. When the cutter bar didn't go all the way down smoothly, the whole carriage on the machine was lifted . . . then dropped back with a thud!

Ordinary motors couldn't take it! Coils loosened and failed . . . bearings went to pieces under the continual punishment!

In 1936, A. W. Hamilton, Chief Electrician, and J. S. Graves, President, decided to try one Lo-Maintenance Motor . . . as an experiment. Then they waited for what they were afraid would happen. But it never did! That Lo-Maintenance Motor took the job in its stride . . . didn't break down . . . didn't need time out for repairs!

Better Service . . . Bigger Savings!

No wonder that now every channeling machine at the Alberene Stone Corporation is equipped with a Lo-Maintenance Motor! No wonder Mr. Hamilton says, "Because our channeling machines are often operating in very inaccessible locations, the Allis-Chalmers Motors, by eliminating the necessity for frequently changing motors, have given us many extra productive machine and man hours!"

When you install a Lo-Maintenance Motor, you get more than just a rated horsepower . . . more in service . . . more in dollars and cents savings. And there's no skimping on materials . . . for Lo-Maintenance construction is husky, full measure construction!

High carbon steel frame . . . indestructible rotor and distortionless stator . . . and Allis-Chalmers 90 years of advancing with industry — all these are plus features . . . plus features that make Lo-Maintenance Motors stand up for years under conditions that many times wreck ordinary motors.

Learn the whole story of why industry is switching to Allis-Chalmers Lo-Maintenance Motors . . . how they can do a better job for you . . . at less cost! Call the nearest Allis-Chalmers district office, or write direct to Allis-Chalmers, Milwaukee, Wisconsin.

. . . 90 Years of Engineering Superiority Work for You When You Specify Allis-Chalmers!

1059

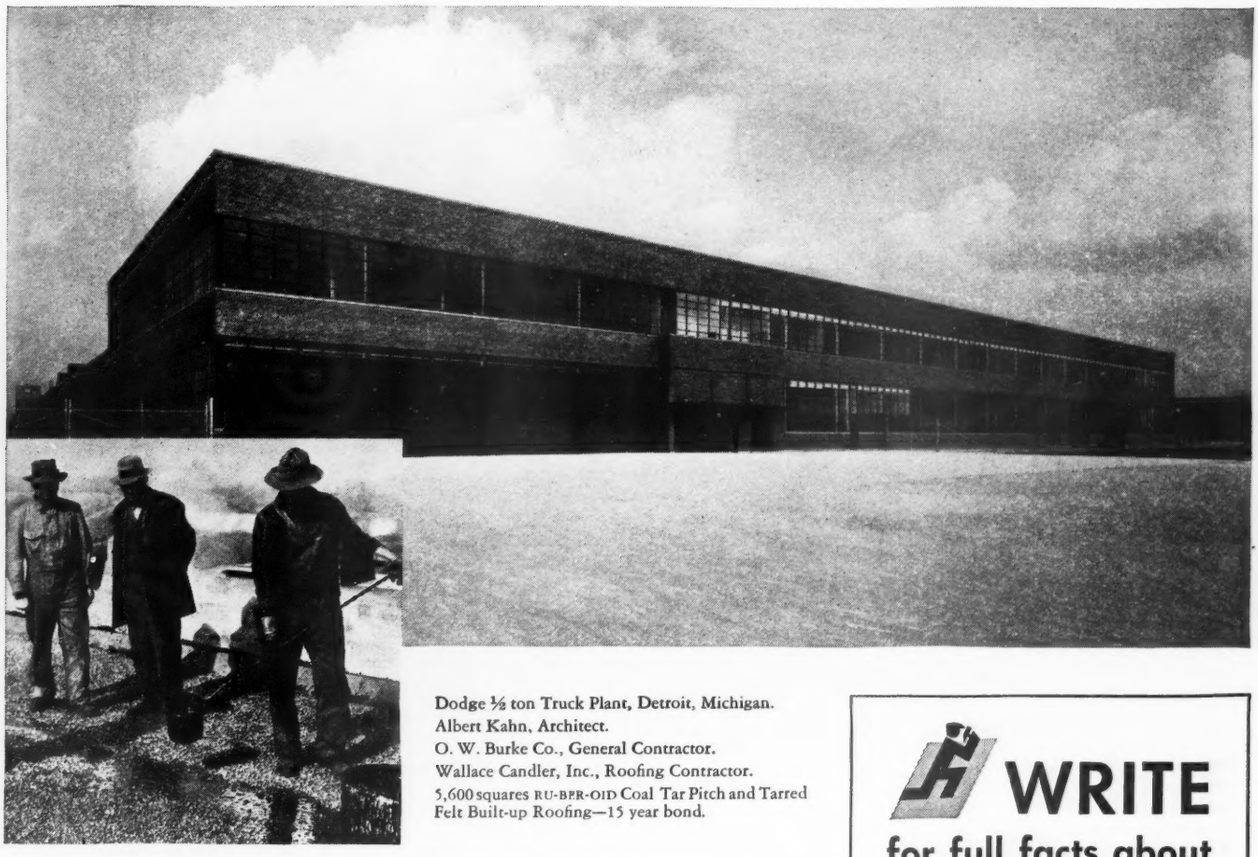
ELECTRICAL DIVISION

ALLIS-CHALMERS

MILWAUKEE·WISCONSIN

ROOFING FACTS

Every Factory Executive Should Know



Dodge ½ ton Truck Plant, Detroit, Michigan.
Albert Kahn, Architect.
O. W. Burke Co., General Contractor.
Wallace Candler, Inc., Roofing Contractor.
5,600 squares RU-BER-OID Coal Tar Pitch and Tarred Felt Built-up Roofing—15 year bond.

IF YOUR PLANT needs a new roof or if you intend to build, select a RU-BER-OID Built-up Roof. Your selection gives you two assurances: the endorsement through use, of America's leading architects and engineers, and the backing of a company with more than 47 years' roofing experience.

The specifications for RU-BER-OID Built-up Roofs are time-honored. They are custom-built to meet the needs of various roof designs—to meet the anticipated life of the building—to meet different climates, fire hazards, fumes, etc. RU-BER-OID Roofs have stood the test of time in all parts of the world—convincing testimony of RU-BER-OID's long life and economy.

When RU-BER-OID Built-up Roofs are laid by an approved roofing contractor, you can have a guarantee of both materials and workmanship. This guarantee is backed by a National Surety Bond for a period of 10, 15 or 20 years, depending upon the specification.

The price range of RU-BER-OID Built-up Roofs makes them attractive for any work. We urge you to have on file complete specifications of RU-BER-OID Built-up Roofs of all types. Mail the Coupon Now.

WRITE
for full facts about
RU-BER-OID
INDUSTRIAL PRODUCTS

The RUBEROID Co.
500 Fifth Avenue, New York, N.Y.

We are checking those that particularly interest us.

- ☐ RU-BER-OID Built-up Roofs
- ☐ RU-BER-OID Rigid Roof Insulation
- ☐ 4.2 Corrugated Asbestos-Cement Sheets
- ☐ 85% Magnesia Pipe Covering
- ☐ Genuine RU-BER-OID Roll Roofing with Patented 7-layer Seams
- ☐ High Temperature and Asbestos Pipe Coverings

FM-7

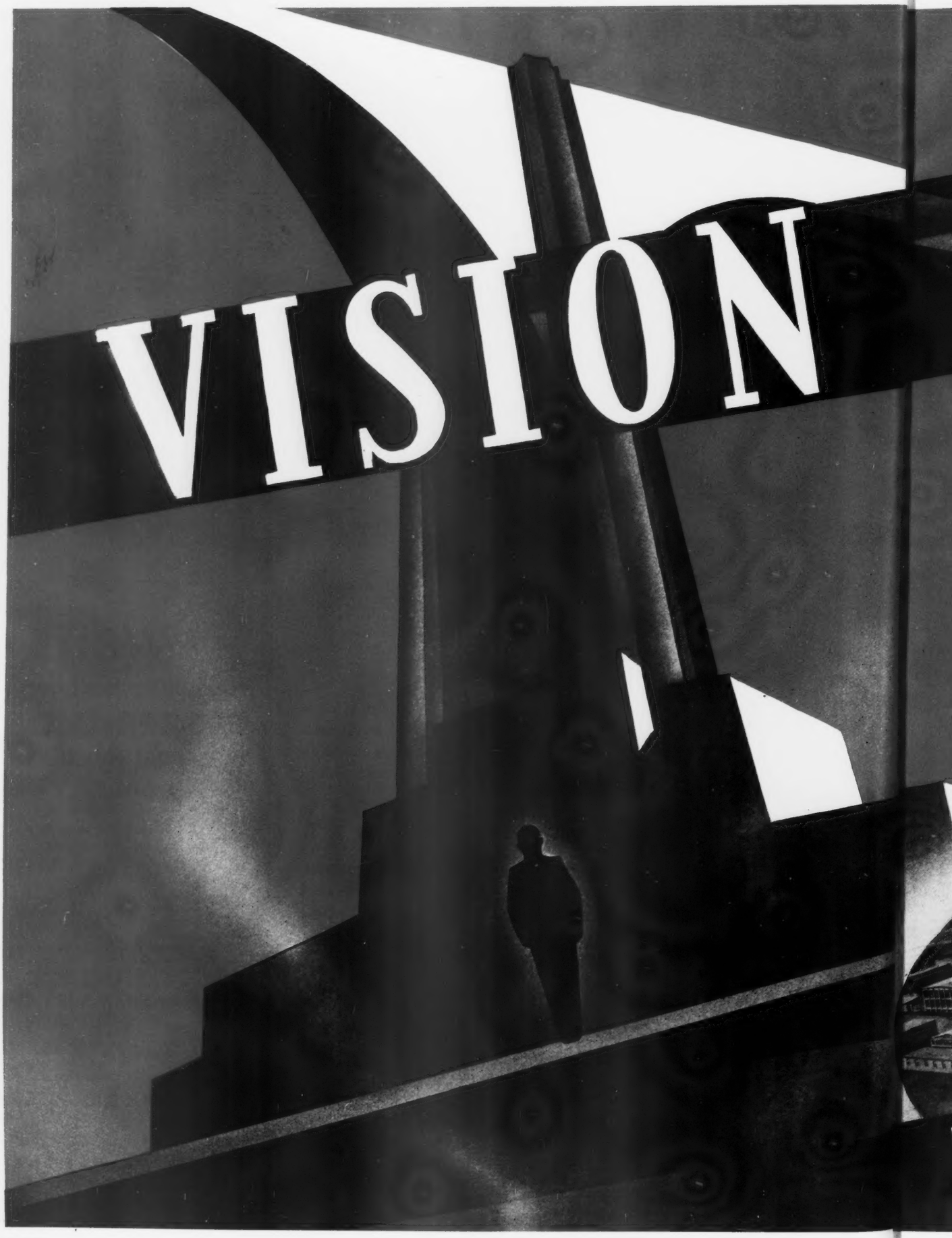
*Name of Company*_____

*Name of Individual*_____

*City*_____ *State*_____

RU-BER-OID BUILT-UP ROOFS

THE RUBEROID CO., EXECUTIVE OFFICES: 500 FIFTH AVENUE, NEW YORK

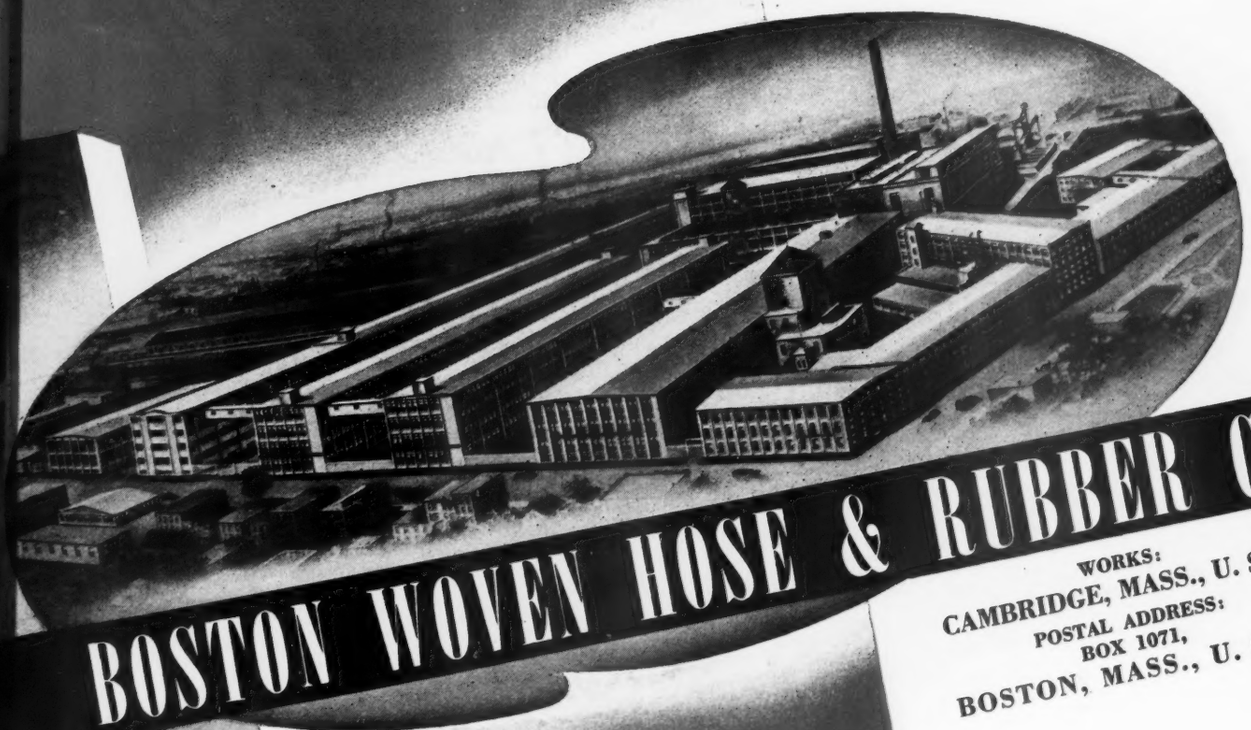

VISION

VISION is of TWO KINDS— THE ABILITY TO SEE and the POWER TO FORESEE . .

B. W. H. has been making Mechanical Rubber Goods for 61 years — each year's product dependable because of the ability to know the adaptation of the product to the job — but vastly more important, each succeeding year's production better because of the faculty of B. W. H. technologists to foresee new and vital improvements in process and product.

It is a demonstrable fact that during the 61 years of its service to industry B. W. H. has contributed more to the invention and perfection of Mechanical Rubber Goods than any manufacturer in the industry.

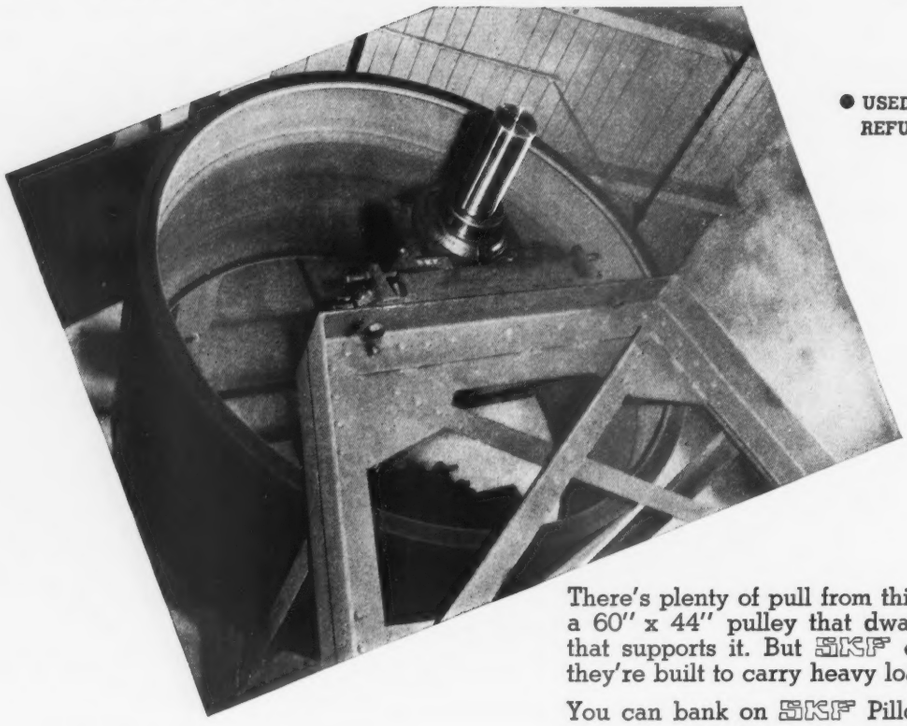
The vision behind the manufacture of any product is of tremendous importance to those who depend on that product for service, safety, and operating economy.



BOSTON WOVEN HOSE & RUBBER CO.

WORKS:
CAMBRIDGE, MASS., U. S. A.
POSTAL ADDRESS:
BOX 1071,
BOSTON, MASS., U. S. A.

BEARINGS HELP THIS LINESHAFT TO TAKE THE PULL



● USED BY
REFUGE COTTON OIL CO.

There's plenty of pull from this 42" double leather belt on a 60" x 44" pulley that dwarfs the SKF Pillow Block that supports it. But SKF can take the pull easily, for they're built to carry heavy loads.

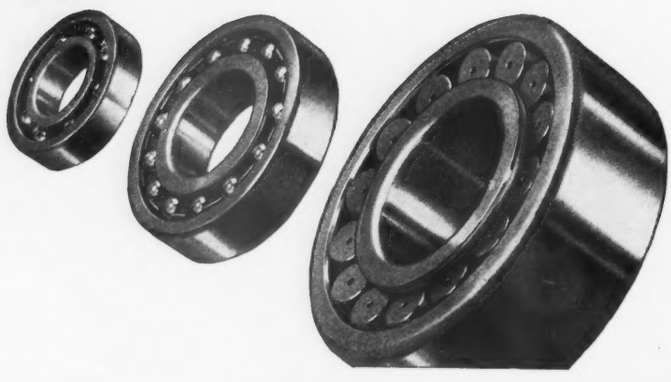
You can bank on SKF Pillow Blocks wherever there is belt pull, dust, dirt and moisture. They're *immune* because they're tailor-made for the bearing. In addition, they prevent lubricant leakage because a center groove is drained by a hole leading down to the drain plug.

Made for shaft sizes from 5/8" to 30" in diameter, SKF Bearings and Pillow Blocks often pay for themselves inside of two years' time. An SKF distributor near you can show you some interesting figures on prices, sizes, types, etc., so see him TODAY. 4335

SKF INDUSTRIES, INC., FRONT ST. & ERIE AVE., PHILA.

THE BEARINGS ARE SKF

BALL & ROLLER BEARINGS



115 QUICK PRACTICAL WAYS TO *Aid* LABOR TO *Cut* COSTS TO *Save* TIME TO *Increase* PROFITS

USE MODERN TRADE **AUTOMATIC** MARK

ELECTRIC MATERIAL HANDLING EQUIPMENT

USE THE COUPON

You can now choose the *exact* model essential for your *individual* requirements from the *115* Standard "AUTOMATIC" Models. These are built in capacities from one to thirty tons to meet requirements of *Every Industry*.

Each model is designed to fit the job constructionally—mechanically—electrically—with the latest engineering features. For ultimate safety to men—Greatest efficiency in operation—Economical and dependable service.

The models illustrated are typical of the complete line of "AUTOMATIC" Industrial Trucks—Tractors—Cranes. No doubt *YOU* have a job right NOW!!! which one of these standard "AUTOMATIC" Models can do for you. If not a standard model, perhaps a special or modified standard "AUTOMATIC" will.

So write today or better still phone the "AUTOMATIC" Sales Engineer nearest you. Discuss your problems freely without obligation.

AUTOMATIC TRANSPORTATION COMPANY
DIV. OF THE YALE & TOWNE MFG. CO.
39 W. 87th St. CHICAGO, ILL.

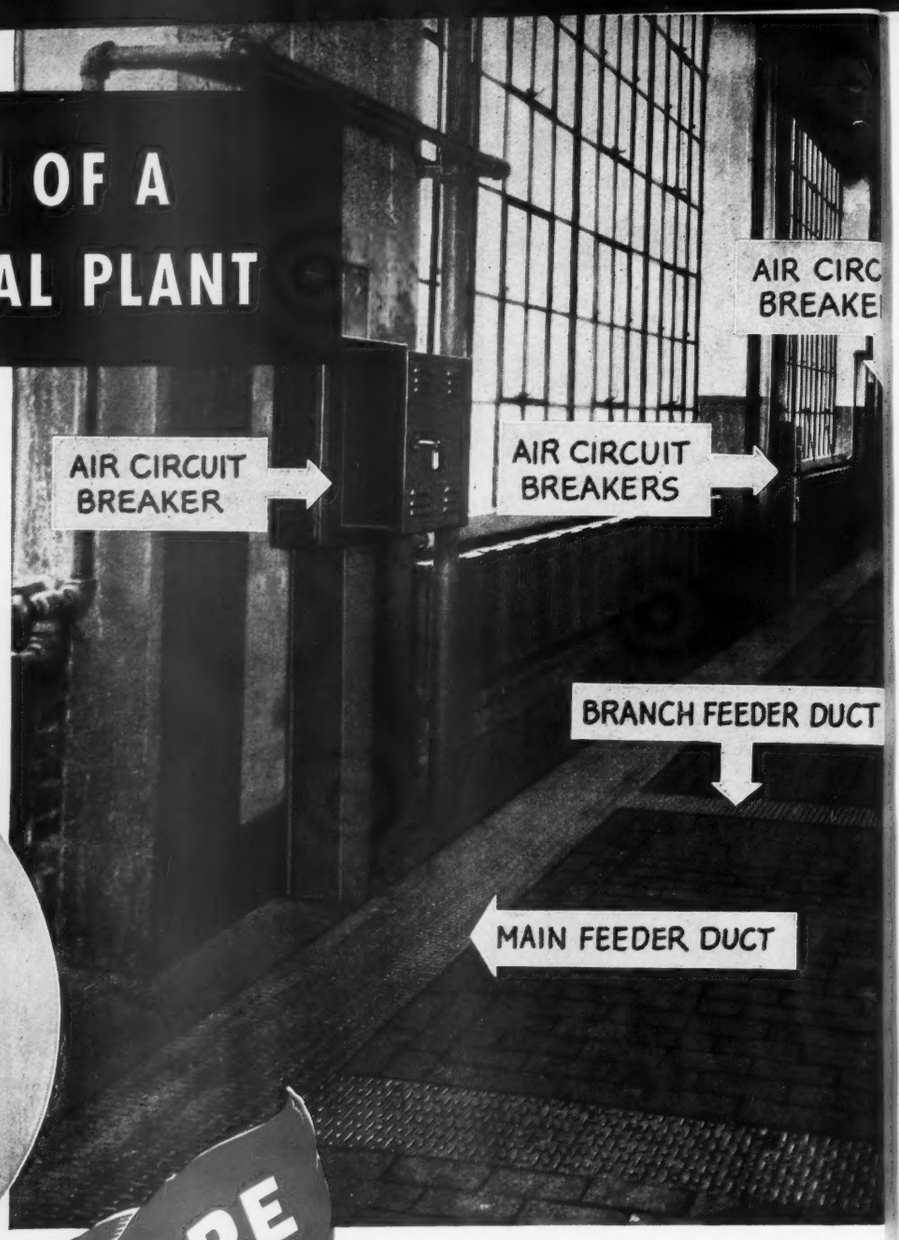
Gentlemen: Please send details on trucks referred to by No._____
or send the Automatic Catalog.

Name_____ Position_____
Address_____
Company_____
City_____ State_____

WHEN YOU BUY TRUCKS - - *Buy* "AUTOMATIC"

THE SURE SIGN OF A MODERN INDUSTRIAL PLANT

Air Circuit Breakers on All Main and Branch Feeders



He's not afraid. He knows it has plenty of "I C"

"I C" = Interrupting capacity

G-E air circuit breakers are available with interrupting ratings up to 80,000 amperes. You can depend upon getting the specified rating whether the breakers are mounted separately or as factory-assembled boards. If you have any question about how to determine the interrupting capacity needed, in order to know the size of circuit breaker to use, get in touch with the nearest G-E office.

THE severity of a short circuit depends largely on the capacity of the transformers that feed the circuits, and it can *not* be determined by the normal load on the circuit. As plant loads have grown, transformer capacities have been materially increased. Therefore, short circuits present an ever-increasing hazard. They seriously endanger personnel and property wherever the power supply has outgrown the interrupting capacity ("I C") of the protective devices.

Are you sure of your "I C"? With G-E air circuit breakers of ***known*** interrupting capacity, you *can* be sure.

GENERAL ELECTRIC

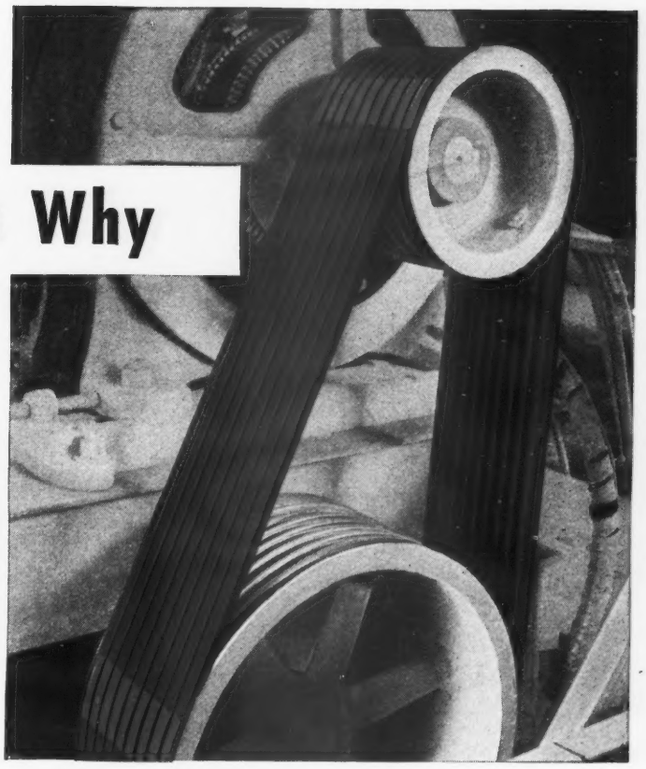
890-79

There are 8* Reasons Why

This Drive is Equipped With

Condor

WHIPCORD V-BELTS



One of a group of Condor V-Belt installations in a prominent cement mill.

And every one is a rea$on—a wear-$aving, $ervice-giving rea$on—therefore, eight rea$ons for putting Condor Whipcord V-Belts on your drives.

The 8 Points of Balance* are the "technical talk" that explains why Manhattan's original construction keeps down internal heat by a strong, endless whipcord member in the neutral axis area; by a compression section below for steady grip in the groove, regardless of load variations and flexing; by lateral reinforcement against wear and squeezing.

Make a note *now* to order Condor Whipcord V-Belts for the next replacement or new drive, so you, too, can get first-hand experience in Manhattan's $ervice of $aving wherever belt drives are used. Meanwhile, write for Bulletin 6868 which contains clear, easy-to-read facts about V-Belt construction and service.

*8-POINT BALANCED CONSTRUCTION

1. Minimum Ultimate Stretch.
2. Wide Margin of Effective Strength.
3. Uniform Flexibility.
4. Maximum Resistance to Structural Breakdown.
5. Smooth Running.
6. Maximum Traction.
7. High Resistance to Side Wear.
8. Correct Lateral Reenforcement.

Condor PRODUCTS

Conveyor and Elevator Belt	Hydraulic Hose	Launder Lining
Transmission Belt	Oil and Gasoline Hose	Industrial Brake Blocks and Lining
V-Belt	Sand Blast Hose	Molded Rubber Goods
Air Hose	Steam Hose	Rubber Lined Tanks
Contractors Hose	Suction Hose	Rubber Covered Rolls
Fire Hose	Water Hose	Abrasive Wheels
	Chute Lining	

MANHATTAN — PASSAIC, N.J.

THE MANHATTAN RUBBER MFG. DIVISION
OF RAYBESTOS-MANHATTAN, INC.
EXECUTIVE OFFICES AND FACTORIES
46 Townsend St., Passaic, N. J.

Designed and Constructed by The Austin Company

STANDARD REGISTER USES INSULUX FOR

Light-Conditioning Plant and Offices

The Standard Register Company's Dayton plant is as efficient as its product... perforated multiple business forms. The offices and 150 x 360-ft. press shop are not merely lighted but *light-conditioned* with Insulux Glass Block. Panels of Insulux flood interiors with even, diffused daylight.

Just as important, Insulux helps control inside temperatures, because it has high insulation value. Insulux reduces noise and dust infiltration. Maintenance costs are extremely low.

When you build or remodel, consider the many advantages of light-conditioning with Insulux.

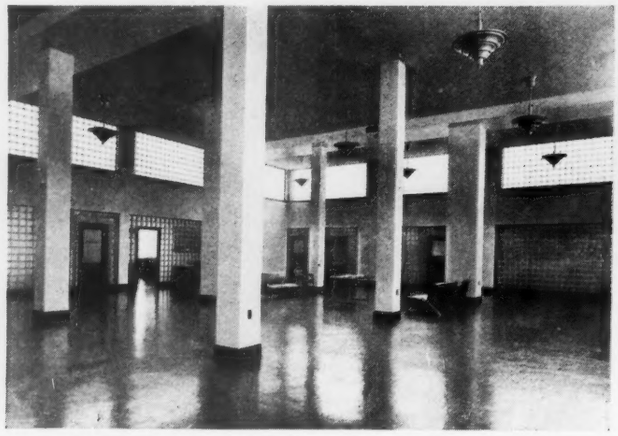
OWENS – ILLINOIS

INSULUX Glass Block

OWENS-ILLINOIS GLASS COMPANY • *Insulux Products Division, Toledo*

MONITORS and wall panels of Insulux Glass Block provide diffused daylight throughout the large press shop. Insulux controls the amount of available light transmitted, depending on design selected.

OFFICE WORKERS reach high efficiency when Insulux gives eye-saving light, plus privacy that keeps attention on work. Note inside wall partition of Insulux to transmit daylight to other offices.



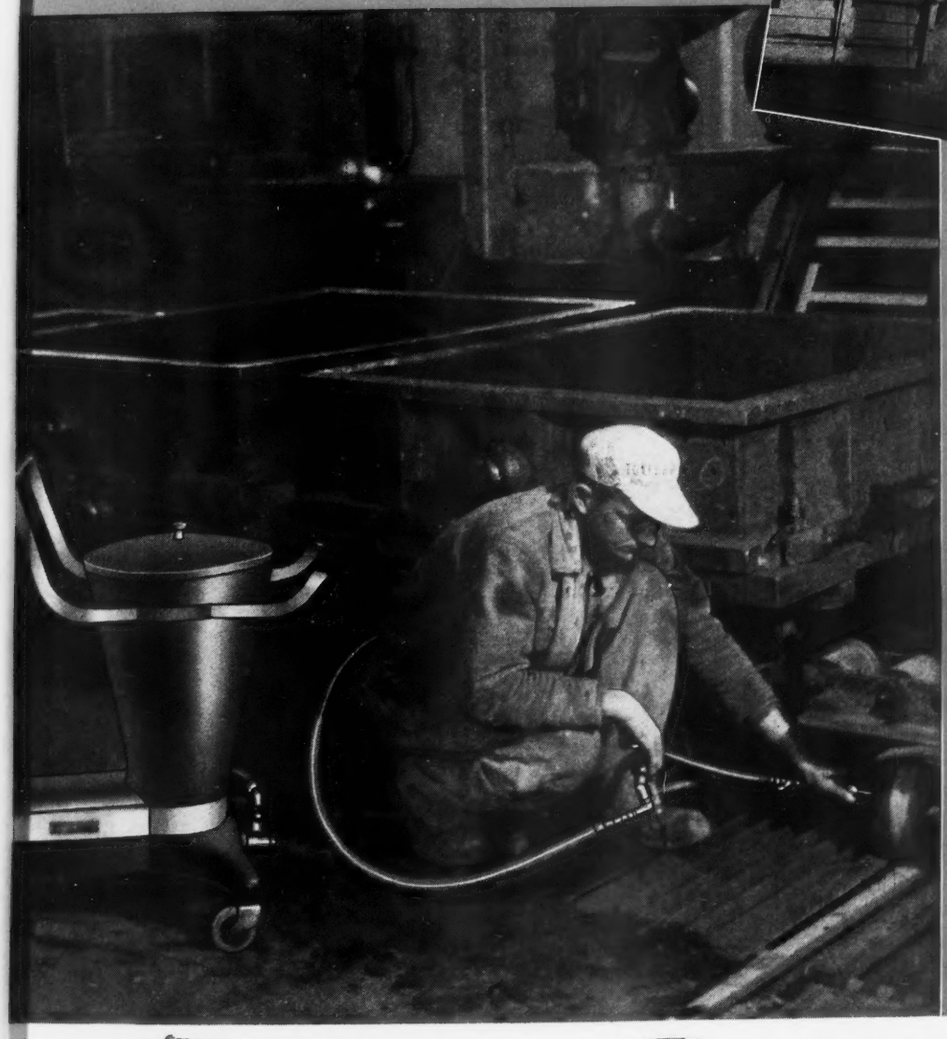
THERE'S BEAUTY as well as utility in wall panels of Insulux Glass Block, as this photograph shows. Minimum upkeep, too—just occasional cleaning, no painting.

HEAT... WATER... SAND...

ALL FOUNDRY LUBRICATION HAZARDS LICKED BY ALEMITE

REG. U. S. PAT. OFF.

Lubrication Equipment!



James B. Clow & Sons Say: "Write Your Own Testimonial On Our Experience With Alemite Guns"

HEAT is an enemy of lubrication. WATER tends to wash out lubricant—attacks bearing surfaces. SAND can cut the bearings to pieces. Any lubrication system, to survive long in a foundry, *must lick all these serious hazards.* James B. Clow & Sons, Coshocton, Ohio, say their Alemite Equipment fills the bill! . . .

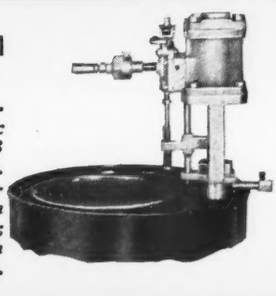
Bearings on their 12-ton mixing ladle operate at 250° F. On the DeLavaud Pipe Casting Machine, the bearing is *entirely under hot water.* Bearings on the sand discharge conveyor are *exposed to sand.* Both *heat and abrasive attack the bearings on the gravity conveyor* shown in the large photograph, where the operator is using an Alemite 6515 Rock Crusher Power Gun to lubricate wheel bearings. In every case, Alemite Equipment not only forces lubricant into bearings—flushing out sand-filled, heat-weakened, water-thinned grease—*but it does the job safely,* allowing the operator to maintain a safe distance from danger.

Whatever your particular power lubrication problem may be, *you'll find an Alemite Power Gun tailored-to-measure to do the job*—swiftly, safely, with longer life for important bearings and expensive machines! Write today for your FREE copy of our new catalog!

ALEMITE
REG. U. S. PAT. OFF.
A Division of Stewart-Warner Corporation
1870 Diversey Parkway, Chicago, Illinois. Stewart-Warner-Alemite Corporation of Canada, Ltd., Belleville, Ontario

Model 6515 Air-Operated Alemite Power Gun

Holds 40 pounds viscous, fibrous, or plastic lubricant; develops 33 times air pressure used. Easily portable; exclusive helix arm and worm prevents air pockets; comes complete with 10-ft hose and adapters.



Model 6700 Alemite High Pressure Pneumatic Barrel Pump

Screws directly into bung hole of 400-lb. grease drum; designed for volume high pressure lubrication of large bearings. Available in different piston ratios for 600 to 7000 lbs. pressure.

Model 6524 Alemite Electric "Rock Crusher"

Exclusive patented helix arm and worm positively prevents air pockets! Holds 40 lbs. lubricant—fibrous, plastic, or viscous; develops pressure of 5000 lbs. per sq. inch. Easily portable.

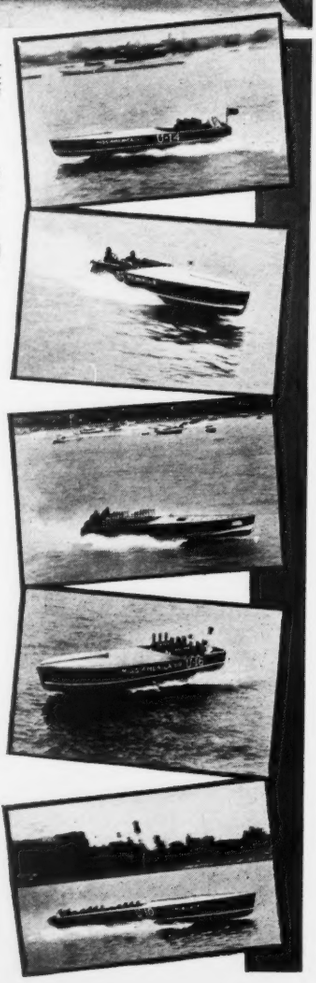
WORLD'S LARGEST MANUFACTURER OF LUBRICATION PRODUCTS

At GAR WOOD 1 to 10 jobs per day scheduled to 170 Machines with McCASKEY

Gar Wood Hoist and Body Division built 300 of these telescopic hoist refuse units for the City of New York.

* * * *

A few of Gar Wood's famous speed boats. Gar Wood Industries includes seven manufacturing divisions.



MR. R. V. SEAL, Efficiency Engineer of the Hoist Plant of Gar Wood Industries, Inc., Detroit, Michigan, tells briefly how their machine scheduling methods have stood the test of varying volume requirements:

"Scheduling from one to ten jobs a day to 170 machines involved frequent headaches until McCaskey Machine Control was adopted in the spring of 1937. The parts for seven divisions of Gar Wood Industries, Inc., are machined in this plant. Under normal conditions, rush orders from several divisions invariably are demanding special attention in addition to the usual flow of production. Delivery dates often are difficult to meet—or were, before McCaskey methods simplified the problem."

"We can now determine at a glance the total hours of work on hand for each machine. Jobs are scheduled so that machines are loaded evenly and used most advantageously. Delivery dates are met and precedence is readily given to rush jobs."

"When production volume is at a peak, reference to the work on hand for each machine quickly indicates the shifts required to clear it up without delay. Similar data is equally useful as a basis for determining the hours per week that are available, when volume is down."

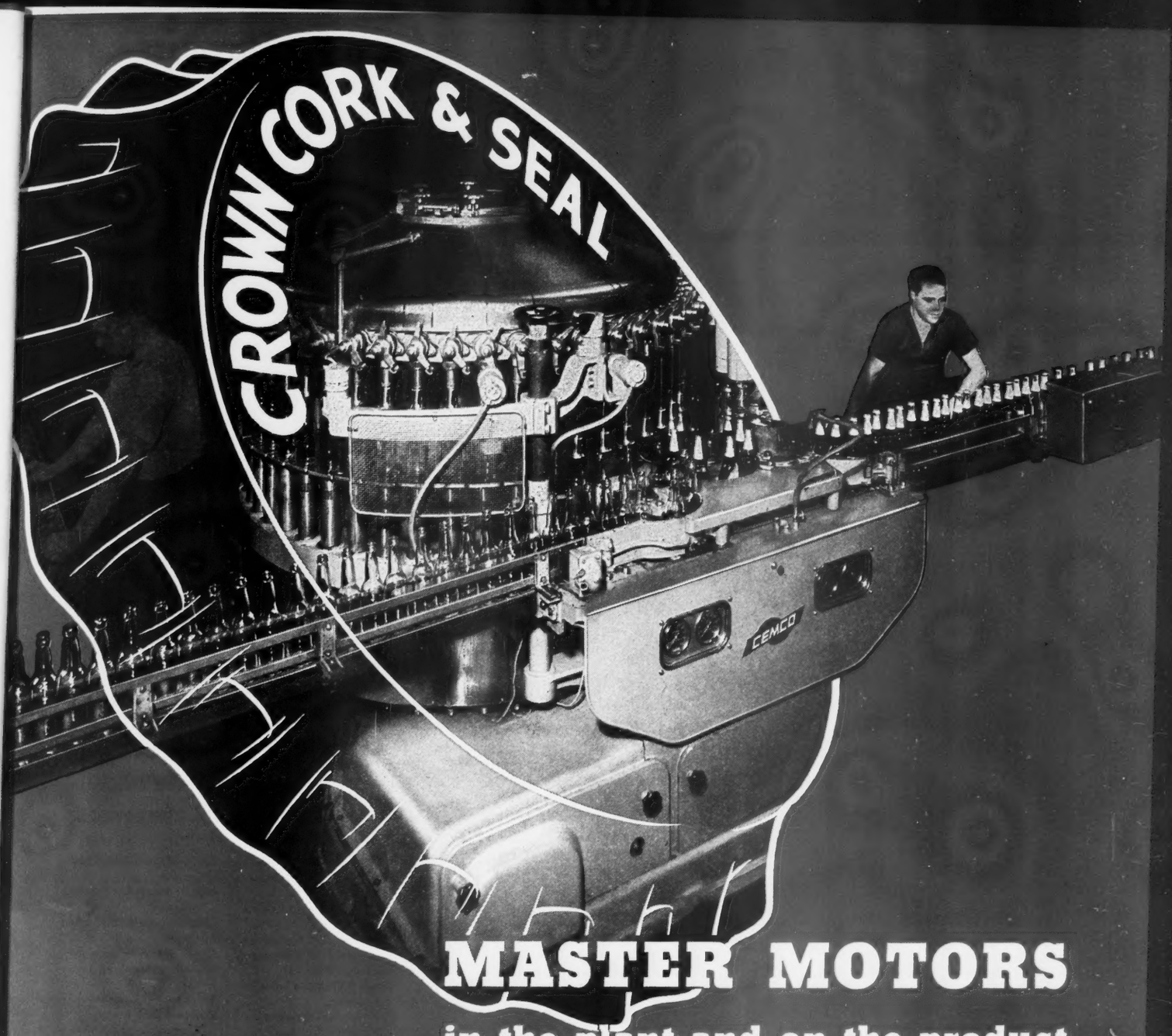
"These results have been secured with a minimum of clerical work and with a surprisingly small original investment. McCaskey Machine Control has been most satisfactory to us."

Your production requirements undoubtedly are different, but every McCaskey installation is tailor-made to meet specific conditions. Write for further data on Machine Control, for the pamphlet "Simplified Production Control", or pamphlets describing other McCaskey Industrial Controls. No obligation.

THE McCASKEY REGISTER COMPANY, ALLIANCE, OHIO

McCASKEY INDUSTRIAL CONTROLS

PRODUCTION • INVENTORY • MAINTENANCE • TOOLS • COSTS • PAYROLL



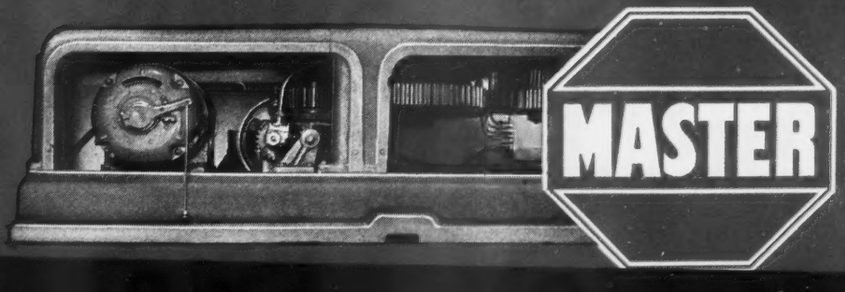
MASTER MOTORS

in the plant and on the product

Another leader in their field, Crown Cork and Seal Co., manufacturers of crown corks and bottling equipment, have found that it pays to use Master Motors built to meet exactly the requirements of each job, whether it's in their plant or on their product. Crown Cork and Seal engineers know that Master Motors engineered to fit each application add greatly to the economy, safety, compactness and convenience of their equipment.

When you need motors for your plant or your product, get the added advantages of using Master Motors that have been built to really meet the exact individual requirements of YOUR job.

THE MASTER ELECTRIC COMPANY • DAYTON, OHIO



How to Get ALL the LIGHT You Pay For and *PAY LESS* to Get It!

TURN LOX *is the Answer!*

DIRTY REFLECTORS WASTE LIGHT!

As much as sixty per cent of the light you pay for can be wasted by dirty reflectors. Not only is this a waste of money but it is a waste that prevents your employes and your business from obtaining the maximum benefits of Better Lighting.

IMPORTANCE OF MAINTENANCE

Obviously, it is only when your Better Lighting is maintained at its original efficiency that you provide light that enables employes to see better and faster, that conserves vision, reduces eye fatigue and thus makes work easier, minimizes spoilage and reduces accidents.

WHY TURNLOX!

Ten years ago, Benjamin first introduced the TURNLOX SYSTEM for regularly maintaining industrial lighting reflectors at their original lighting efficiency with less time, greater safety and at the lowest possible cost.

Basically the TURNLOX SYSTEM is composed of two elements, a hood permanently connected into the wiring system and a reflector, which with the lamp makes up a separable unit that can be easily attached or detached.

A TURN AND IT IS LOCKED!

A simple quarter *turn* and the reflector engages in the hood and *locks* positively into position whether the light is on or off. Electrical and mechanical connections are made automatically.

A TURN AND IT IS UNLOCKED!

A simple quarter *turn* with a slight upward pressure releases the *lock*, permitting the reflector with lamp to be taken down as a complete unit for easier and faster washing on the floor. There is nothing to unlatch or unscrew—both hands are always free to guide and hold the reflector.

SAVES CLEANING TIME!

Thus with a few extra reflectors on hand it is even possible to change a bay at a time, replacing dirty reflectors with ones previously cleaned.

Moreover, with the patented Floor-Service reflector changing tool, reflectors may be removed and replaced safely from the floor—without ladder or interruption to production.

SEND FOR COMPLETE DATA AND DEMONSTRATION

For complete details on various types of Benjamin reflectors available with the TURNLOX SYSTEM, ask for booklet AD 3966 which we shall be glad to send you without cost or obligation. Address Benjamin Electric Mfg. Co., Des Plaines, Ill.

Since the First TURNLOX Installation 10 Years Ago

PROGRESSIVE PLANTS

Like These Have Specified Benjamin TURNLOX-EQUIPPED REFLECTORS

Allis Chalmers Mfg. Co.
American Can Company
American Tobacco Co.
Anaconda Wire and Cable Company
Armstrong Cork Company
Bethlehem Steel Company
Bridgeport Brass Co.
Brown Williamson Tobacco Company
Bucyrus-Erie Company
Buick Motor Company
J. I. Case Company
Caterpillar Tractor Co.
Chain Belt Company
Chrysler Corporation
Cluett Peabody & Co., Inc.
Coca-Cola Company
Colts Patent Fire Arms Mfg. Co.
Consolidated Aircraft Corporation
Deere & Company
Delco-Remy Corporation
Douglas Aircraft Co., Inc.
Dunlop Tire and Rubber Corporation
E. I. DuPont de Nemours & Company, Inc.
Eastman Kodak Company
Gaylord Container Corp.
Heald Machine Company
Kellogg Company
Kellogg Switchboard and Supply Company
Kraft-Phenix Cheese Corporation
Leeds and Northrup Co.
Lehigh Portland Cement Company
Lever Brothers, Ltd.
Libbey-Owens-Ford Glass Company
Liggett and Myers Tobacco Company
Liquid Carbonic Corporation
Lockheed Aircraft Corp.
Glenn L. Martin Company
Mechanic's Universal Joint Company
Nash Motors Company
National Cash Register Company
North American Aviation, Inc.
Olds Motor Works
The Owens Illinois Glass Company
Philadelphia Storage Battery Company
Philco Radio & Television Corporation
Procter and Gamble Co.
RCA-Victor Company, Ltd.
Ralston Purina Company
R. J. Reynolds Tobacco Co.
Servel Incorporated
Socony Vacuum Oil Company, Inc.
Standard Brands of California, Inc.
Stewart-Warner Corporation
Studebaker Corporation of America
Sylvania Industrial Corporation
Tennessee Eastman Corporation
United States Gypsum Co.
United States Rubber Co.
Universal Atlas Cement Company

BENJAMIN Turnlox

LIGHTING EQUIPMENT

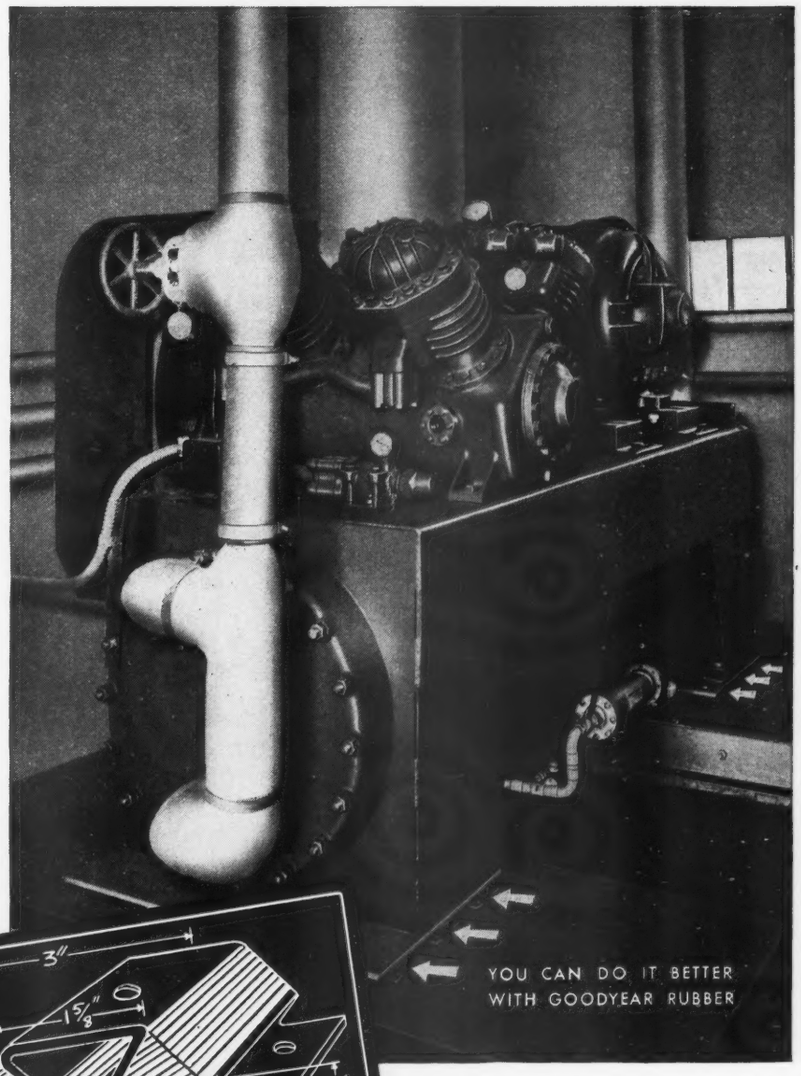
Distributed Exclusively Through Electrical Wholesalers

HERE'S A

Silent Cure

FOR ALL HIGH-SPEED MACHINES WITH

Vibration Jitters



Air conditioner mounted on Goodyear rubber vibration dampener in Memphis store.

THE floor-shaking vibration, the rhythmic nerve-shattering 'ammer, 'ammer, 'ammer characteristic, of so many high-speed machines has met its match in Goodyear rubber. Today air conditioners, compressors, ventilating fans, generators and other jittery equipment are being cushioned to tiptoe silence by an ingenious Goodyear development—the Universal Vibration Dampener.

The amazing effectiveness of this rubber cushion is best illustrated by typical examples like these:

A printing press recently installed in a large Ohio hotel to print menus and programs caused so much vibration throughout the building that guests were seriously disturbed. On recommendation of the G.T.M.—Goodyear Technical Man—the press was mounted on Goodyear rubber dampeners. It is now inaudible, even in adjacent rooms.

In a mid-western office building there were many complaints about the noise of an automatic numbering machine used by one of the tenants. When it was cushioned on Goodyear rubber, people on the floor below thought their noisy neighbors had moved, the silence was so complete!

In mills and factories the dampener not only silences noise—it does away with excess machine-motion, permitting cleaner, quicker work on high-speed operations.

Elimination of noise and vibration is only one of the many modern industrial problems being solved by applications of rubber-to-metal. Abrasion, corrosion and excessive impact are others. Let the G.T.M. show you how you can do it better with Goodyear rubber. To have him call, write Goodyear, Akron, Ohio, or Los Angeles, California—or phone the nearest Goodyear Mechanical Rubber Goods Distributor.

THE GREATEST NAME IN RUBBER

GOODYEAR

A Centennial Product of The Greatest Name in Rubber

TOUGH...?

THEY HAVE TO BE TOUGH TO "TAKE IT" IN THIS PLANT!

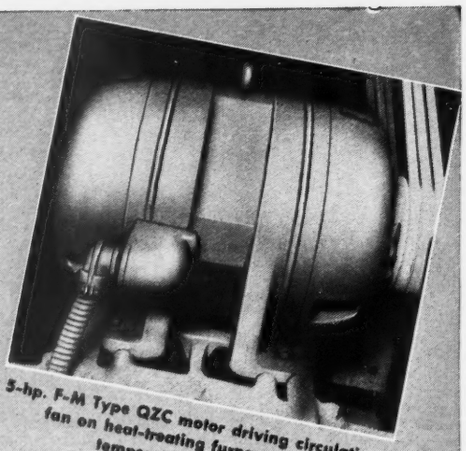
The Electric Auto Lite Company plant at Fostoria, Ohio has no easy job for motors. Here a motor has to work in air laden with destructive magnetic-iron dust, in extremely high temperatures, and under other difficult conditions.

In spite of these conditions—every Fairbanks-Morse motor in the plant has rendered dependable, low-cost service year after year, because when Fairbanks-Morse builds a motor for tough going—*they build a tough motor.*

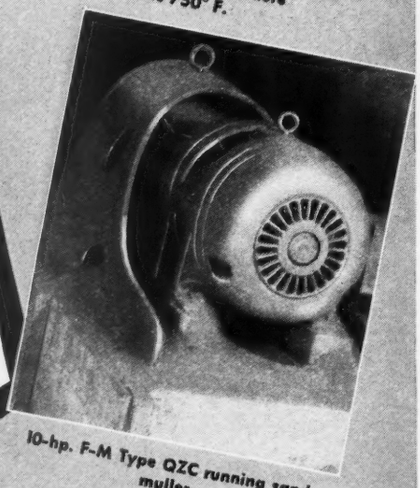
Take F-M Fan-cooled motors, for example. Air is drawn in at *both* ends of the motor by nonclogging, one-piece fans, eliminating hot spots. Ball bearings are sealed in lubricant. Moving parts and windings are completely protected. Leads won't pull out or short—because they are welded—not soldered. These are only a few of the reasons why so many F-M motors are used on tough jobs.

For complete details, write Fairbanks, Morse & Co., Department 30, 600 S. Michigan Avenue, Chicago, Ill. Branches and service stations throughout the United States and Canada.

7615-EA40.149



5-hp. F-M Type QZC motor driving circulating fan on heat-treating furnace, where temperature is 750° F.



10-hp. F-M Type QZC running sand muller.

30-hp. F-M Type QZC motor driving another sand muller.

15-hp. F-M Type QZC motor driving casting rattler.

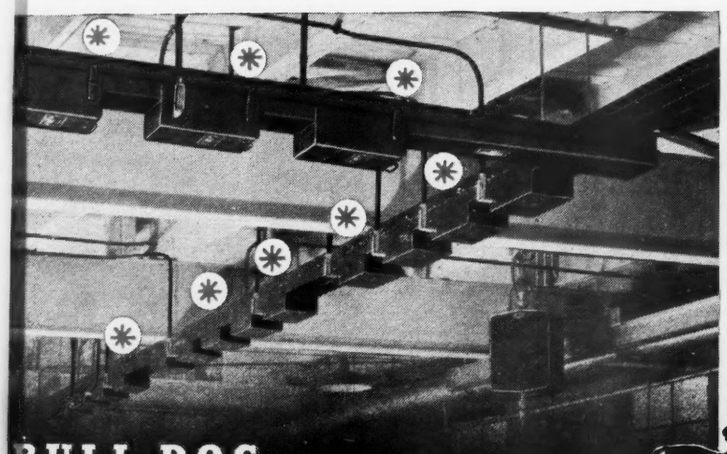
FAIRBANKS MORSE

DIESEL ENGINES
PUMPS
ELECTRICAL MACHINERY
FAIRBANKS SCALES
RAILROAD EQUIPMENT
WATER SYSTEMS
WASHERS-IRONERS
FARM EQUIPMENT
STOKERS
AIR CONDITIONERS

Motors

PLUG IN* MACHINES and LIGHTS as Easily as You Plug in Your Toaster at Home!

Bull Dog BUStribution for POWER and TROL-E-DUCT for LIGHTING, installed in your plant, mean that you can plug-in for current at any time, and at any location, where power or lighting circuits are required



BULL DOG BUStribution FOR POWER

BUStribution — a duct-enclosed busbar system, gives your plant a completely flexible system of Power Circuits. With convenience outlets spaced every 12" of the duct run, power circuits can be plugged-in WHEREVER and WHENEVER needed BUStribution also permits a choice of Circuit Protective Plugs; these may be either Fusible Switch Type or Automatic Circuit Breakers And if the future develops other types of Circuit Protective Devices, these could also be adapted to your BUStribution system. If changes in plant layout or other conditions, necessitate electrical changes, these can be met without delay and without a lot of re-wiring. BUStribution for Power is Adaptable and Modern — and can be kept MODERN

Flexible Electrical LAYOUTS at Minimum Financial OUTLAY

The TROL-E-DUCT 5 Ft. Handy Set

is an ideal Trol-E-Duct unit for use over drill presses, lathes, etc., which, for less than $4.00, will enable you to judge the merits of the system and its possible applications in your plant.

With Terminal Type Trolley...
$3.75 LIST

With Receptacle Type Trolley....
$4 LIST

BULL DOG Trol-E-Duct FOR LIGHT

If your plant were TROL-E-DUCT equipped, you would never have to worry about the problem of adequate lighting. For every inch of Trol-E-Duct is a potential receptacle into which, by means of movable Trolleys or Twistout Plugs, all types of lighting units may be readily connected for current This permits you to spot your lights just where you need them, either for GENERAL or LOCAL lighting and you can move the lights along the duct run, to meet changes in plant layouts or requirements. As new and finer types of luminaires are developed you can readily adopt them for your plant without delay and without the expense of re-wiring, if your plant is TROL-E-DUCT equipped. TROL-E DUCT for lighting is *Adaptable* and *Modern!*

Consult Your Local Bull Dog Jobber or Write for Illustrated Bulletins

ADEQUATE WIRING SERVES AND SAVES

BULL DOG ELECTRIC PRODUCTS COMPANY

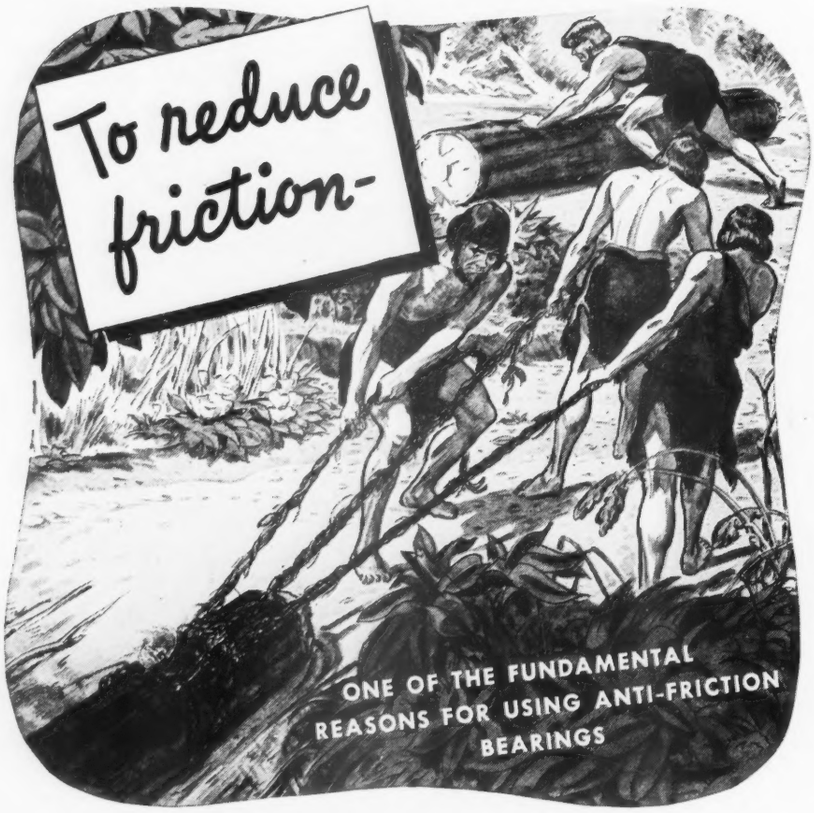
MANUFACTURERS OF Vacu-Break Safety Switches, Panelboards, Switchboards, Duct Systems — FOR LIGHT AND POWER

DETROIT, MICHIGAN

BULL DOG ELECTRIC PRODUCTS OF CANADA, LTD., TORONTO, ONT.

ORIGINATORS OF FLEXIBLE ELECTRICAL DISTRIBUTION SYSTEMS FOR LIGHT AND POWER

WHY ANTI-FRICTION BEARINGS?



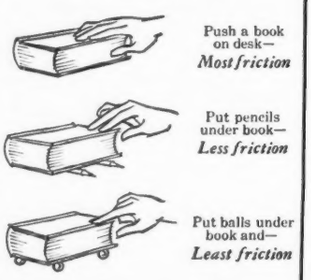
WHEN MAN found that loads could be moved easier by *rolling* instead of *dragging,* he discovered the first principle of the anti-friction bearing.

Later . . . when he learned to produce steel balls, he had the basis for the *ideal* anti-friction bearing. For a ball has no ends—carries loads from any direction—requires no guidance other than its grooved path. And . . . rolling between steel race rings, has less friction than any other form.

To reduce friction! That is one fundamental reason for using anti-friction bearings . . . for using *ball* bearings . . . for using New Departure ball bearings.

For interesting brochure, AT-12, "Friction *was* a Racketeer," write to New Departure, Division General Motors Sales Corp., Bristol, Connecticut.

Demonstrating the evolution of basic bearing types



Nothing Rolls Like a Ball!

NEW DEPARTURE

THE FORGED STEEL BEARING

2782

FACTORY
MANAGEMENT and MAINTENANCE
L. C. MORROW, Editor

Public Relations and Industrial Relations Are Siamese Twins

WHAT HAS INDUSTRIAL RELATIONS to do with public relations? It is a question frequently asked. The answer is of obvious importance to industry. Here it is as we see it, stated as briefly and simply as possible.

Public relations means, literally, relations with the public. The public of a given manufacturing concern is made up of the people who buy or use its products, the people who sell its products, the people who make its products, the people who furnish the money to make its products, and the people who live in the community where its products are made.

The groups just described constitute the public proper. There is an additional, bystanding group that is important. It is composed of people who talk about the company. The individuals in this group are likely to be public figures—politicians, reformers, labor leaders, or just plain gossips.

In this day and era industry is suspect. Many people believe that industry is wilfully scamping on its products, grinding down its workers, misleading in its advertising, overly enriching its stockholders. It is fair to admit, once again, that *some* companies do all those things. But let's insist, too, that *most* companies do not. That much is said for the record; it is unimportant in comparison with the fact that people feel as they do.

Because people feel as they do, it is the public relations job to set them straight. By advertising, by dealer education, by visits through the plant, by plant magazines, by reports to employees, by "publicity" of the right kind. These tools, by and large, are to be used in direct dealing with the public as a whole. All of them are very much worth while. But they must, as a rule, be used by relatively few people, and then under executive direction.

On the other hand, each employee can be an emissary of good public relations for his plant. Right there is the real answer to the question, "What has industrial relations to do with public relations?" The employee influences public feeling about the company for which he works. When he feels that his plant is a good place to work, that his company understands his problem as well as its own, and is fair in its dealings with him, he says only good things about his company. The reverse is true; when he is not satisfied, or feels that he is treated unfairly, he will say so. He is not likely to say nothing.

Imagine the employees of *every* industrial concern saying only good things about the companies for which they work. There are something like 9,000,000 employees in the manufacturing industries alone. At an average of three family members in daily contact with each employee, the number of people with favorable opinions increases to 36,000,000. These 36,000,000 have other than family contacts, so that the number of people influenced is increased again. The net result is a formidable army of good-will builders.

The reactions of the people composing this large group eventually get to the bystanding, talking group of politicians, reformers, labor leaders. The ammunition for propaganda by the latter group is reduced, and their audience for propaganda is reduced.

If this reasoning is correct, industrial relations counts for much in public relations. It gives new meaning to the frequently repeated statements, "Public relations begins at home," and "Industrial relations *is* public relations."

Management's Job—As I See It

One, management must obtain the physical plant and equipment; two, recruit personnel; three, find customers; four, serve society. Let's look at the responsibilities involved in all four

CHARLES R. HOOK

President, American Rolling Mill Company
Middletown, Ohio
Chairman, National Association of Manufacturers

FROM OUR COMPANY'S EXPERIENCE of more than 40 years, and from our observation of the results attained by others during this same period, a certain few facts stand out crystal clear in respect to management. But before undertaking to state these truths, it might be well to consider briefly the major interests affected by any industry and the points at which it touches these interests.

The first step in manufacturing is to obtain the physical equipment, which consists of production equipment and materials, and the necessary structures and auxiliary services to house the process. The equipment and material are originally provided from funds put into the enterprise by stockholders, out of their savings.

Next step is to recruit the personnel to operate the plant—which means, as American industry is learning more conclusively year after year, to provide the entire working force from factory sweeper to executive head with working conditions, compensation, and job security adequate to make the work attractive.

Third, the management must find customers, the folks who provide the flow of money through the business to meet the payrolls, meet the month's bills, and—if possible—have a little something left for the stockholders.

Finally, the management must perform a genuine service to the public—to what the economists refer as society. This means that it must not only earn for the shareholders a fair rate of return on their investment, supply attractive employment, and produce good quality and value in its merchandise, but it must also justify its existence as a citizen of the group that authorizes it to operate. In passing it may be remarked that while an overwhelming proportion of all business has actually performed in this fashion, entirely too many business citizens have failed to make known to their fellow-citizens the useful, beneficial service they are giving. This is at the root of much of the artificially induced difficulty in which business finds itself today.

The theorist may feel that the proper order has not been observed in listing these four major obligations—i.e. to stockholders, wage earners, customers, public. Admittedly, any business should and can keep foremost its obligation to the public and to its wage earners. But under the incentive system that has produced for the people of the United States the highest standard of living and the richest, freest way of living yet developed in the world, it is necessary for the continued well-being of any business that it maintain its financial stability and that it maintain itself as attractive for the investment of the people's savings. Therefore it is essential that its management aim always toward profitable operation, which will keep it in position to pay its stockholder-owners a fair return on what they have invested.

In our own company the stockholders have provided some $11,000 of investment for each worker employed. Presumably there will arise at some future time a technological advance in steelmaking like our company's development of the continuous strip mill.

May Need Millions

When that time comes, it may conceivably be necessary that we raise a good many millions of dollars to take advantage of the improvement, perhaps even to keep our company in position to compete. Otherwise we might eventually lose position in our industry or even be forced out of existence. In order that we may continue to provide desirable employment, deliver to customers the goods they need, and serve the public interest by producing more and better goods to contribute to an ever-higher standard of living, we must give our stockholders a fair deal.

This obligation to the people who supply the tools of industry is all too often overlooked in superficial thinking. Certainly, if the incentive system

(Continued on page 130)

Charles R. Hook is not only nationally known as one of American industry's most sagacious leaders. He's also the pride of his own home town—as witness the "Community Appreciation Dinner" thrown in his honor a few weeks ago by the citizens of Middletown, Ohio. Said the principal guest speaker on that gala occasion:

"Back in 1904 Charley Hook invited the men of American Rolling Mill to form a committee to confer with him on matters of mutual interest. We talk a lot about collective bargaining now as if it were a new creation, but Charley Hook voluntarily established it with his men 35 years ago.

"In more recent years Charley Hook has been the leader of a small band of business men who felt that the American economic system was worth fighting for, and who determined to defend and preserve it from the attacks that were being made upon it. . . . To him goes a large share of the credit for making industry vocal in its own behalf"

48 Weeks at 40-Hour Pay

The man who gave "multiple management" to industry now offers a "multiple skill and universal transfer plan" designed to give employees all-year work at all-year pay

Charles P. McCormick was born long enough ago so that he quit college to serve in the Navy during the War. While in Johns Hopkins, he supplemented the meager allowance received from his foreign-missionary father by working in the plant of his uncle's firm, McCormick & Company. After the War he went back to the factory and worked—not to learn to be an executive, but to make his living. Eventually his uncle put him on the road as a salesman, where he combed the South for grocers who needed his line of spices, teas, and related goods. He combed so successfully that, in spite of his being a nephew, the boss moved him back to Baltimore and after some years made him a vice-president.

In 1932 his uncle died and McCormick was elected president. Being an admittedly lazy fellow who shuns excessive responsibility, he promptly devised "multiple management" to let his bright young men carry part of the load; the plan is not unknown, having been widely adopted meanwhile—at no profit to its inventor.

He also disliked the extra work of hiring and firing folks who came and left with seasonal demands. Se he took a leaf from the ice-and-coal merchants and added new products to fill the valleys. Then, to simplify the problem still further and thus leave himself more time for vacations, he developed the multiple-skill personnel and universal transfer system described in this article

CHARLES P. McCORMICK

President, McCormick & Company, Inc.
Baltimore

UNLESS A MANUFACTURING BUSINESS has the great good fortune to have a continuously even flow of orders, or a bankroll big enough to permit filling warehouses indefinitely with its products in times of shrunken sales volume, it faces one basic principle when it tries to give regularized employment. Its personnel must be adaptable to a variety of jobs, both in skills and in spirit, if they are to get year-round work and pay.

For some years now we have given a 48-week year of 40-hour weeks, with some small amount of paid overtime, to all our employees. At the foundation of this achievement have been our management's determination to level employment, and our planning to develop a versatile force of people.

A few visitors from other concerns have viewed our set-up at close range and have told us that we go further toward job versatility than any concerns they know. We cannot make any such claims in our own right, for the simple reason that we do not know too much about what others are doing in this field. Our own methods have been pretty much cut out of the cloth available to us. And since they have been getting for us the results we sought, we have had no occasion to do much research outside our own four walls.

I have said our management is determined to stabilize our employment. The reasons for such a policy are obvious and require little elaboration. Our employees will be better satisfied, will wish to give us better value in exchange for their wages, and because they remain with us instead of drifting to other jobs will be better able to deliver value for the dollars we pay them.

Besides—for some odd reason connected with human reticence, most employers do not mention this—it makes the men at the top feel a lot better when they go home at night if they do not have to know they have just shoved another fifty or a hundred people out on the street. If you *must* explain every-

thing susceptible of decent humane interpretation in terms of profits, put this one down as producing more efficient executives because they don't have to worry about the folks they have laid off.

The start of our internal stabilization policy is in the attitude of our employees. Whether they are old-timers who have caught the contagion from others, or whether they are new ones who were told it when they were hired, the great bulk of our people consciously recognize that they are working for McCormick & Company—that they are not working for the spice department, the extract department, or the plant maintenance department of the southeastern division of the sales department.

To be sure, Sally is normally assigned to packing spices, but she and we agree that, if we want to use her services elsewhere this is part of our deal. If the advertising department needs Sally to stuff circulars into envelopes, or if we decide she should demonstrate McCormick products in a local food store—well, it's a McCormick job, she's a McCormick employee, and she goes cheerfully to whatever job is assigned her.

Assuming that one of these jobs is higher paid than packing spices and Sally becomes so good at it that she is transferred to it as her regular work, naturally her wage goes up accordingly. If it is just a fill-in to care for the absence of an employee who is sick—and probably getting paid while she is off—or is a transfer to keep from laying Sally off, she gets her regular wage.

Multiple-Skill People

Besides the people's attitude of willingness to adapt themselves to changing circumstances, we have also a high degree of double-skill or multiple-skill people on our payroll. For example, when we need a typist or stenographer, we seldom have to go outside our own force. Our personnel department has a record of dozens of girls in production jobs who are qualified for office work, who would rather have office work than factory work, and who have been promised consideration whenever we have an office opening to fill.

Because of our willingness to transfer across departmental lines, the ambition in our employees need not be repressed. Many of the girls on the office-applicant list went to night school to learn office work. Some of them are smart enough to keep on going to school to learn more than one office practice. But an equally important source of office-competent girls in factory departments is in the girls who are hired. There is at our employment office, as at any other, a

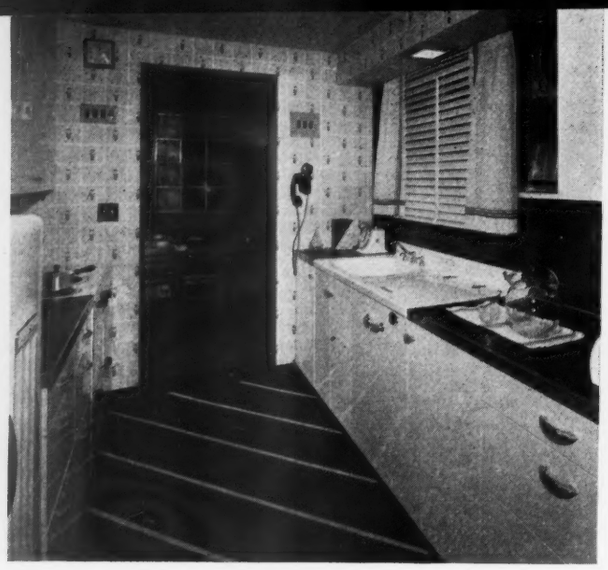
(Continued on page 128)

Dozens of girls on regular production jobs are well qualified for office work. This operator was drafted from the extract filling department to help out in an emergency

A factory-trained employee turns salesman, is apparently doing a bang-up job of work

Today she's demonstrating in a grocery store. Tomorrow may find her selling at some food show or other. Next week you might see her back on the spice packaging machines

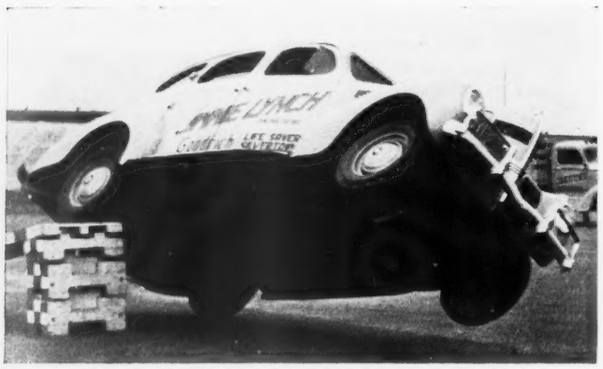
Compare values . . . 1913 Chevrolet—4 cylinders, 31 horsepower, $1,125, 2,215 pounds, 50 cents a pound . . . 1939 model—6 cylinders, 85 horsepower, $782.55, 3,025 pounds, 26 cents a pound



General Electric kitchen in "The Bride's Home" in "The Town of Tomorrow." American housewives can have equipment like this only because industry makes full use of technological advance

Better Products at Lower Prices

Fresh out of the research laboratory is Nylon, a man-made fiber that promises more stocking for fair-sex dollars. It also promises 1,000 new jobs in the $8,500,000 plant du Pont is building



Tiremakers would count that year lost in which they had made no improvements in their product. That's why Jimmie Lynch can do a stunt like this at the Goodrich show and live to tell the story

Mrs. Modern stacks her dishes thus. She'd still be doing them by hand if Westinghouse—like all American industry—had not always aimed at better products at lower prices for more people

Big press turns out 2,160 inner shells for Ford hub caps while the skilled worker at the bench hammers out one. And it can do them for 12½ cents apiece against $2.50 each when made by hand

Back of that good new White Owl are not only batteries of cigar machines but also controlled manufacturing conditions which insure uniform quality at the modest price of 5 cents the smoke

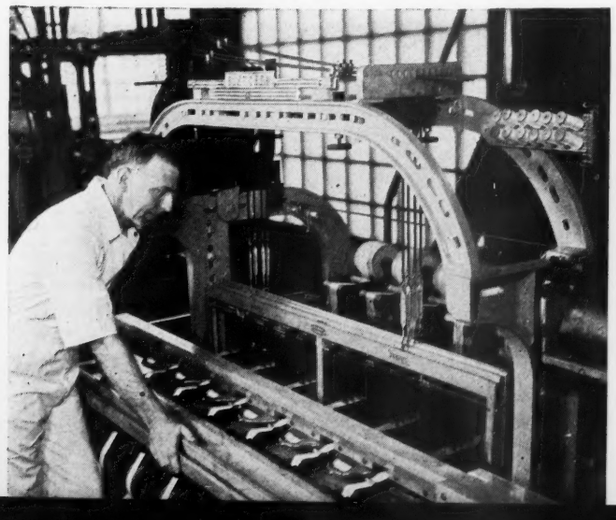
for More People

Shown at the New York World's Fair

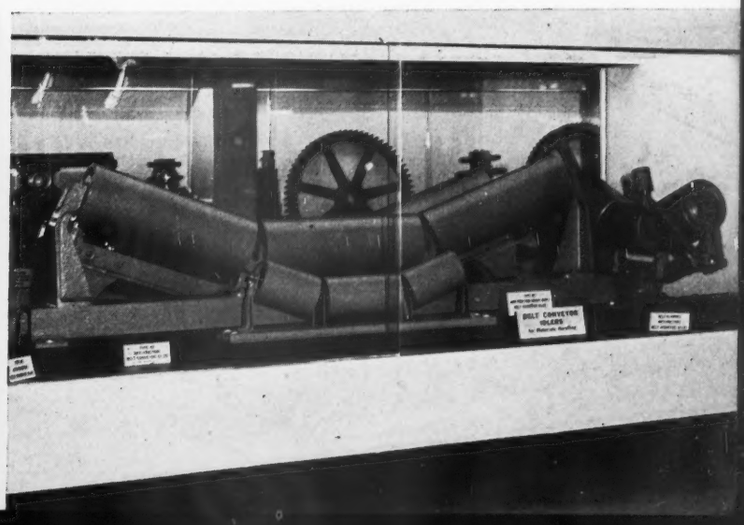
Industry's products mark the difference between bare subsistence and the ever higher standard of living that has been the heritage of succeeding generations of Americans. Industry's machines make products at low cost . . . they are offered at low prices . . . are bought . . . many more people want them . . . more have to be made . . . new jobs are created . . . more people have money to buy with

Every plant has a handling job on its hands. Industry's huge investment in, say, power trucks helps it operate on a low-cost basis. Low costs mean lower prices, more goods sold, more jobs

Only because industry spends millions in research are products like Fiberglass made available; it promises revolutionary developments in insulation, building construction, industrial design



Belt conveyor idlers shown in a corner of the Link-Belt exhibit exemplify capital-goods equipment that is always behind industry's ability to turn out ever better things at ever lower costs



Upwards of 55,000 neighbors—30 per cent of the total population of Lancaster County—dropped in at Armstrong Cork's open house

Now Their Neighbors Know Them

Three more well-known concerns join the rapidly growing roster of those that have found the "open house" one of industry's most effective public relations techniques

LEWIS K. URQUHART

Associate Editor

BILL IS A GOOD WORKMAN and a good family man; he brings his pay envelope home to Mary every week he has one. But Mary knows little about the plant Bill works in and not much more about the work he does. And Bill's neighbors, employed in other industries, know exactly nothing about Bill's job and the company that employs him.

Fortunately the aura of mystery surrounding Bill's job is easily dispelled. Fortunately something can be done about it. Fortunately that something costs little.

We refer, of course, to the "open house" now regarded by manufacturing industry as one of its most useful public relations techniques—and we are going to describe three recent parties of this sort in order to show how simply it's done when the program is properly organized.

Farrel-Birmingham Company

As reported by Walter L. Tann, Planning & Control Engineer, his company set aside an entire day for a complete inspection of its plant by the general public. The thought was to let Mary and the children and the neighbors see where Bill worked, what kind of machine he operated, and what the machinery looks like that Bill helps to build. Out of it all, it was felt that they would get at least a glimmer of the importance of the plant and its products in the national economy.

To make it a 100 per cent employee show, the management turned the whole affair over to a committee of the employees' own choosing, and sat in on meetings only in an advisory capacity, giving help only when requested.

The committee included a hobby show in the program. Entrees ranged from oil paintings, architectural sketches, coin and stamp collections, photographs, and trout flies to a speed boat, and a short-wave broadcasting station in operation, and song recordings. The company donated cash prizes for the three best exhibits, the winners being determined from ballots cast by some 10,000 visitors.

In addition there were exhibits of products made on F-B machinery installed in customers' factories; thus

Mary and the neighbors saw how some product they used every day was helped on its way to them by Bill. A special exhibit of the shop safety committee was included to show that the company makes every effort to keep Bill safe and sound while he's working.

A hobby show was very popular with the visitors at Farrel-Birmingham's open house

Armstrong Cork Company

During the seven days this company held open house, more than 55,000 people—30 per cent of the population of Lancaster County—visited the linoleum plant.

Major committees for the open house program and their principal duties were as follows:

1. *Advisory*—10 key men, one each from major departments.

2. *Publicity*—8 people, including the company's publicity man, who gave full time to the job; distributed news articles; during the open house wrote daily stories for the local press; used paid ads in Lancaster newspapers, advertising cards for outside display on 50 trolley cars.

3. *Registration*—7 members, including official company hostess; trained nearly 100 guides to show special groups through the plant; acted as hosts and hostesses; arranged for registration of thousands of people.

4. *Route and Guide*—5 people, all from production department; laid out a 2-hour route designed to show as many operations as possible, without overtaxing visitors' strength; prepared leaflets showing "where you will go and what you will see."

5. *Route Preparation*—5 people, including foremen of carpenter and electrical shops; built standards for roping off route; erected direction and department signs; built steps, platforms, ramps, display tables, etc.

6. *Safety*—headed by the company's safety engineer; responsible for parking, first aid, safety precautions (most serious accident was a bruised toe caused by one neighbor's stepping on another's foot).

7. *Display*—8 members; exercised general supervision over displays built and arranged by the employees themselves at each operation; also responsible for hundreds of signs explaining operations along the route.

8. *Departmental*—one for each department; responsible for route layout, displays, guides, safety.

Norton Company

Open house at this plant lasted two days—one for the employees and their families, one for local business and professional people.

Organization for the open house included a general chairman and these committees: Reception and Routing; Plant Preparation; Exhibits.

When Norton Company's neighbors came to call, they saw this modern locker room, learned that Norton employees work in a good plant

Controlling Work in Process

J. J. COLBERT and B. A. MOSKI, Jr.
Industrial Engineers

Part 1. Presenting the principles on which work-in-process control rests. No untested theories, their application saved one concern from $3,000 to $6,000 a month, cut stockchasers from 200 to 40. A second part will describe such an application

Jim Colbert wasn't thinking much about work-in-process control when this picture was snapped. But when not entertaining in this fashion he's busy analyzing methods for the electrical concern referred to here. He helped install Bedaux at Fletcher Works, Inc., Philadelphia. Headed piece rates and planning for a General Electric division. Moved over to RCA in Camden and organized a stock and material disbursement system. Still later developed standards for Holtzer-Cabot Electric in Boston

WHAT PROPER CONTROL of work in process means to a plant is demonstrated by the experience of a large nationally known manufacturer of electrical equipment who used to need no less than 200 expediters to keep tabs on parts to see that they arrived at assembly lines on time. Forty expediters now do the job with infinitely better results, since haphazard control measures gave way to the application of fundamental principles governing work-in-process control.

Despite the small army of 200 expediters, proper control had never been achieved—results had always been disappointing. Assembly lines were frequently ready to start, only to find that some small but essential part was missing. Seemingly good planning resulted in nothing but confusion, and more parts than necessary were ordered rather than waste time finding the specific quantities. In one instance, a duplicate purchase of $1,800 was necessary to replace parts that could not be found. It was literally true that truckloads of material were left over through improper control. Waiting time at assembly lines consistently cost the company from $3,000 to $6,000 per month.

When fundamental principles of work-in-process control were applied, the reduction in the number of expediters from 200 to 40 in itself constituted an excellent saving in overhead expense. The cost of waiting time and surplus parts was reduced to a negligible minimum. Improved control of rejects was accomplished. Paper work was cut to a small fraction of that formerly necessary. Schedules became definite promises which were kept —and not meaningless dates.

What are these basic control principles whose application insures the arrival of parts on time at assembly line stations?

All component parts for subassemblies should move simultaneously to the assembly floor. It is poor practice to expedite component parts from raw material stores, machine shops, finishing rooms, or other assembly departments, directly to the assembly floor, independently of each other. Needless confusion, misplacement of parts, and delays in assembly startups are avoided when all necessary parts are sent on one truck or skid, and checked at one time.

Quantities of component parts should be broken down in divisions of the schedule, and delivered intact to the assembly floor. When an order is so large that materials for the entire order cannot be conveniently delivered at one time to the assembly floor, divisions of the order must be established, such as sets of 100. In such cases, each delivery of parts must contain 100 units of each type of part required. Verification of quantities then becomes a simple matter, as the quantity of all parts is identical.

One or more clearing houses or cumulation points should be established to control component parts. It is obvious that the preceding principles cannot be applied unless definite stations are established at which all parts can be concentrated before being dispatched to the assembly floor. It is here that drawings are checked to determine whether or not all necessary parts are ready, and quantities are accumulated for simultaneous delivery to the assembly floor, in convenient divisions of the order.

The cumulation point should be laid out in sections, each section manned by a specialist. A typical cumulation point might consist of one section for machined parts, another for purchased items, a third for wire materials, and a fourth for specific parts peculiar to the industry in question. The advantage of having a specialist for each section lies in the increased knowledge he will obtain in his specific field, assuring faster filling of orders and the elimination of errors in selection of materials. The possibility of assembly delays due to incorrect materials is thus avoided.

Functions of the cumulation point are to cumulate, store, and deliver parts. A copy of all assembly orders goes to the cumulation point, where each specialist determines the materials required. The parts may be received from raw material stores, machine shops, finishing rooms, or other assembly departments. In all cases, the materials are cumulated until all necessary parts are at hand. A few days before an assembly is scheduled to begin, complete sets of all component parts are delivered to the assembly floor, in convenient divisions of the various orders.

When each set of component parts is issued, a corresponding quantity of complete assemblies or rejects must be returned. This principle represents the heart of proper control of rejects. At any time, the number of rejects occurring in the assembly operation is known, and provision may be made for replacement of parts in ample time to insure the correct delivery of a given order. Normal routine for replacement of parts may be followed, eliminating delays and excess costs.

Assembly of any product should not begin until all component parts are available. Strict adherence to this principle will considerably reduce the production cost of many articles. Too many jobs are started with inadequate checking of materials required, or with the knowledge that shortages exist. The subsequent cost of delays, shifting operators between jobs, and the extra start-ups involved represent expense that is wholly unnecessary.

Plant managers and production engineers may well consider these principles of control from the viewpoint of their own particular industries.

The theory underlying the principles is simplicity itself. Manufacturing in its most elementary form contains these principles. When a one-man enterprise begins operations, the producer gets all his parts together and assembles them with apparently no trouble. It is when production reaches a large scale that numerous difficulties are certain to arise.

In stating the principles, the idea of one or more cumulation points was stressed, in order to emphasize the flexibility of application in actual practice. In many cases, a single clearing house may be sufficient to meet the conditions encountered. In other instances, a cumulation point may be necessary at each large subassembly department.

The principles of control are adaptable to both large and small volumes of production. Where large volumes are concerned, substantial savings may be obtained through improved control. In the case of small orders, the margin of profit is too low to afford excess costs, making control imperative.

An important advantage of this control of work in process is its effect upon the schedule. It clearly defines the schedule, and follows it out completely. It locates difficulties in advance of the schedule, and places responsibility at one point. It becomes possible to work closer to the schedule with a minimum of inventory.

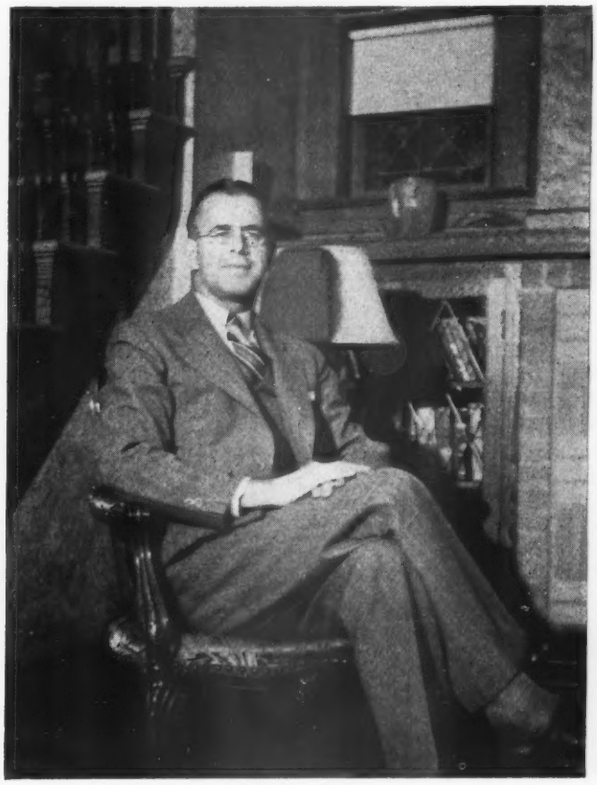
The cost of expediting work in process is greatly reduced through the application of proper principles of control. In the place of many expediters handling a mass of paper work, relatively few specialists are engaged in the physical handling of the actual materials, with a minimum of paper work in the form of accurate records. Where expediters are used, materials are handled over and over again; but with improved control, materials are handled deliberately, without wasted motion.

Physical control of actual materials expedites work in process as no amount of paper work can do. One hundred sets of parts become 100 subassemblies for other assemblies. The control is of materials, not of paper work.

The acid test of management principles lies in their practical application. These principles of work-in-process control are not theoretical. They were developed by the authors out of actual practice, as the result of problems that demanded solution.

That substantial savings have been realized by individual concerns through proper application of the principles, is demonstrated by the company described at the start of this article. This company's product involved a large number of different models, and a great many small component parts. Some parts were machined, while others

(Continued on page 140)



Bruno Moski held a full-tuition scholarship at Yale; in 1927 got his B.S. degree cum laude in industrial engineering. His cadet engineering days were spent in the public utilities field, and after three years he switched to manufacturing industry. Installed and operated the Haynes Manit System at Wilson H. Lee Company, Orange, Conn.; a standard cost system at Goodyear Rubber Sundries Company, New Haven. Now associated with Mr. Colbert at the electrical equipment manufacturing concern alluded to in the article

THE ABCs of PERSONNEL

Don't fancy yourself a big shot and play the martinet. Remember that modesty and naturalness are becoming . . . so be yourself. Next month, O's and P's

CHARLES S. STEVENSON

General Manager, Hall Brothers, Inc., Kansas City, Mo.

SKETCHES BY MATHILDE SCHULZ MUELLER

Mannerisms

"Joe McKinley? Oh yes, he's the young fellow who keeps digging in his head all the time, isn't he?" . . . a strange way to be remembered! It's amazing how many persons are identified by some little personal mannerism rather than by their personalities or their accomplishments. The girl who keeps a bright yellow lead pencil tucked into a nicely groomed head of hair . . . the man who wears a battery of pens and pencils exposed from the breast pocket of his coat . . . the executive who reclines and slouches all over desks . . . the accountant whose infrequent use of his handkerchief probably comes under the heading of careless hygiene . . . the vice-president whose telephone conversations can be heard all over the office—these are examples of mannerisms that are of doubtful help. Ability, of course, will survive any mannerisms, but there's no reason to handicap it thoughtlessly.

Martinet

An industrial leader has said that any successful person will have some of the folks under him irritated and provoked from time to time, the implication being that a successful job requires the urging and prodding of a certain few. His statement will no doubt be met with general acceptance. The proper degree of discipline applied is as varied as are the dispositions of those being reprimanded . . . too *little* discipline is disastrous . . . too *much* discipline is likewise disastrous. This same leader said further: "Some executives move along smoothly; others seem to be in constant turmoil with their subordinates . . . those in authority should give considerable thought to the manner in which they apply their authority." Generals in the French army, known as martinets, enforce authority by sending offenders to the guardhouse; American industry reverses the process and the martinets in it find themselves in our proverbial "doghouse."

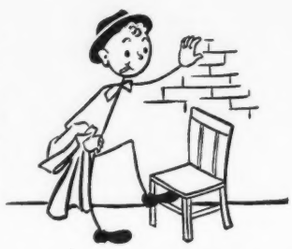
Megalomania

"I promoted my nephew recently, fixed him up in a little office, printed his name on the door, and gave him a couple of buzzers," said a furniture manufacturer. "Well, that scamp started coming late, bought a new car, began to wear checkered coats, and did poorer work in less hours than anyone around the place. . . . I finally yanked him out of the office, and put him back on the time clock. I told him *the bigger the shot, the bigger the explosion.* He caught on!" . . . if you don't try to be a big shot, your chances of *really* being one are improved . . . then when you really get to be one, you'll be too smart to let it show. P.S. A megalomaniac is one who thinks he'sa "big shot"—but usually isn't.

Modesty

One of the most charming and appealing of all the virtues is a proper sense of modesty. One need not be a shrinking violet nor the shy, timid Mr. Milquetoast! To be most effective, modesty should be natural, not forced. Psychologists say that most people could stand much advice on "How to be *less* modest." Happily, they agree, however, that it *is* definitely possible to develop this pleasant and desirable trait. A sales executive, attempting to choose a chief correspondent from five assistants of apparently equal ability, reviewed each one's letters for a month and quickly made his choice. He said: "I simply listed the number of times the writers had started a paragraph with the letter 'I' and gave the job to the fellow who had the fewest I's. I just figured that if he had this modesty in writing to strangers he would exercise it in handling those under him. . . . and to me it seems as if this is one of the cardinal virtues in getting along with people."

Naturalness



Charm schools, organized to develop personality and leadership, lay much stress that Sweet Sixteen be first of all *natural.* Great rewards in the alluring field of romance await those who can build their personality from such a heritage. Hard-headed business men, reading the school's advertisements, smile indulgently, but agree inwardly that such a characteristic is a big help in the very prosaic business world. A group of high school graduates were picking their class motto . . . they shocked their teachers, their principal, and their parents by adopting the phrase "Be Yourself!" But a personnel counselor at commencement congratulated them, saying: "There's some hope for you if you don't forget this slogan in your business contacts. . . . may you never forget it!" If you hear a shout—"Aw, be yourself!"—make sure no one is directing it at you.

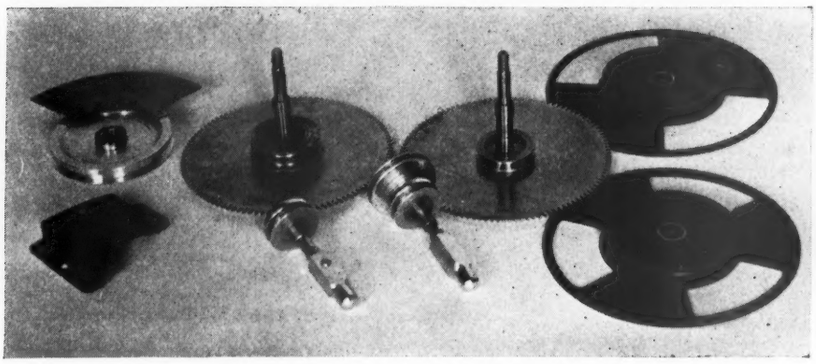


Figure 1. Three- and two-blade shutters at the right were replaced by the single-blade duralumin shutter at the left, which gives only one light interruption per frame. In the center are gears and spindles interchanged in converting the A-72 model

How to Convert Projectors for Motion Study

DAVID B. PORTER and LOUIS P. GRANATH

Department of Industrial Engineering — *Department of Physics*

New York University

NONE OF THE EXISTING commercial motion-picture film projectors has ever been entirely satisfactory for micromotion analysis. The purpose of this article is to describe a conversion of the inexpensive 16-mm. projector so that it fulfills most of the specialized requirements of this work.

In making a motion analysis by means of a film, it is often necessary to run the film slowly, sometimes frame by frame, and either forward or backward, for the determination of critical points. This means that the projector should be of such design that its speed can be easily varied from a few frames a second up to the full speed of sixteen per second, in either direction. The inertia of its moving parts should be sufficiently small so that they can be brought to full stop within a few frames. These operations, variations of speed, stopping, reversing, and frame-by-frame projection should be possible with a minimum amount of thought and effort.

While none of the projectors on the market satisfies these requirements, there are several that can be easily converted.

In operations where the motion is not too rapid, the "slow motion" effect can

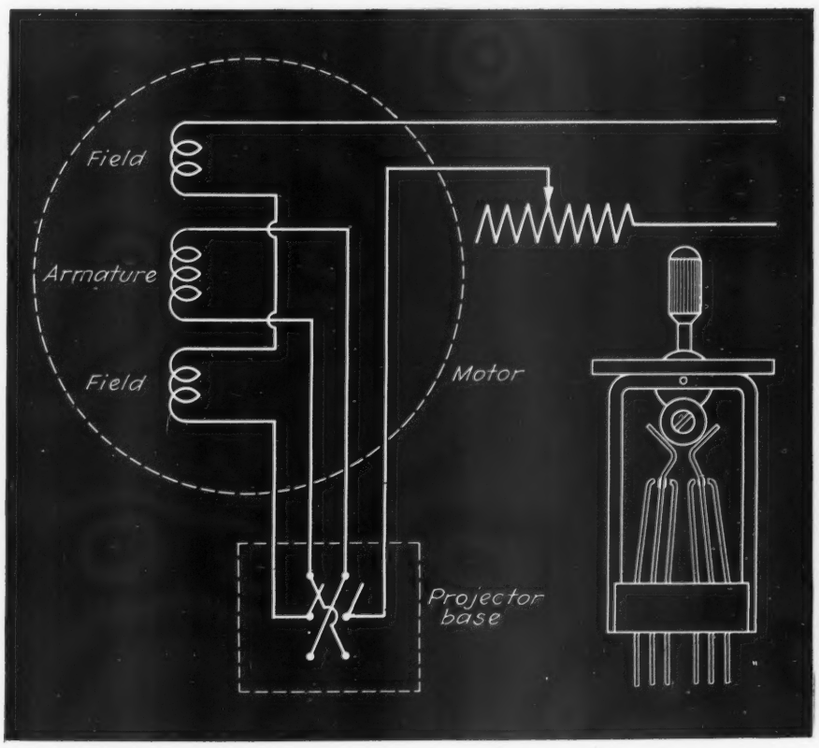


Figure 2. How model D-62 projector was wired to make it reversible. At the right is a sketch of the double-pole double-throw switch by which film movement is controlled

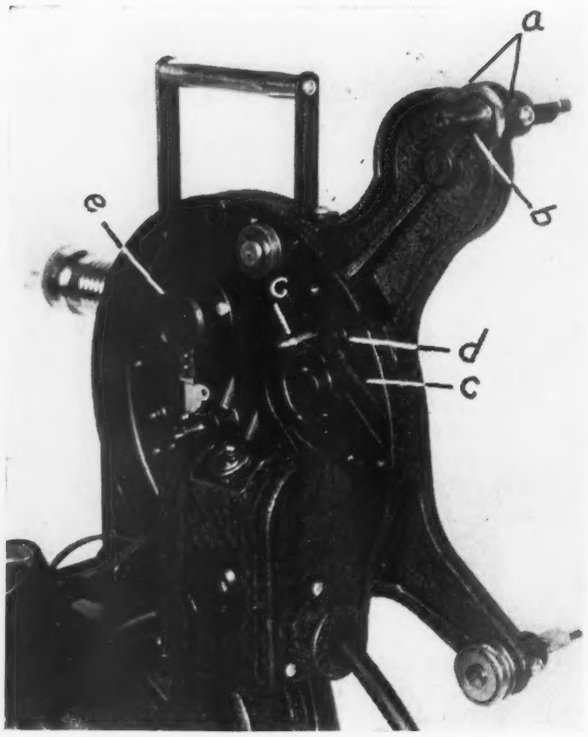


Figure 3. Some alterations had to be made in the A-72 projector to adapt it to the conversion. At *a* metal was cut away so that the pulley would slide all the way down the shaft to *b*. At *c* a piece of metal was removed to allow the belt to enter the pulley on the large gear, and a sheet metal guard for the upper reverse belt was installed at *d*. To prevent blistering the film when the projector was stopped, the heat-resisting glass filter *e* was added between the lamp and the film

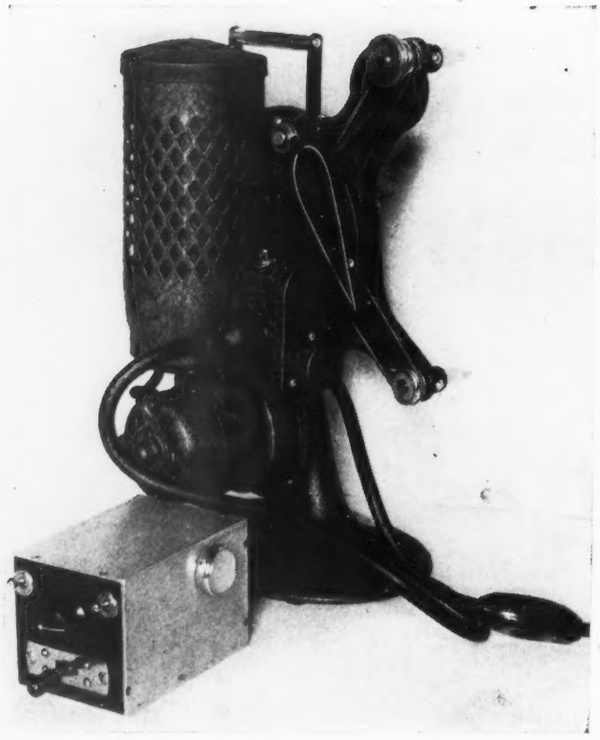


Figure 4. Converted model A-72 and its separate control box containing rheostat, reversing switch, pilot light for illuminating recording desk, and snap switches for the projector lamp and pilot light

be obtained by projecting pictures at less than the normal speed of sixteen frames per second, provided the action photographed is not so rapid that blurring of the image occurs. When the projector is run at less than normal speed, the flicker becomes noticeable and at very low speeds uncomfortable.

Since the eye is much more sensitive to flicker than to intermittent motion, the best projectors are so designed that the light will be interrupted three times per frame, and in the high-wattage machines four times per frame, one of the interruptions occurring while the film is in motion. When the speed of projection is reduced to about two frames a second, the flicker rate is reduced from a frequency that is unnoticeable to a very annoying rate of from six to eight a second. The action still appears continuous, however, but it is not easy to concentrate on it; also, in frame-by-frame projection it is difficult to tell when the film has moved, due to the multiple light interruptions per frame.

In the ideal machine the flicker rate would be constant at about 64 per second with a variable film speed of 0 to 16 frames per second, the light being shut off while the film is in motion. When we found that no commercial machine could be conveniently converted into this ideal one, we decided to use a variable rate of flicker of such frequency that at slow speed the light interruptions would be so infrequent that the eye would concentrate primarily on the action, and at normal speeds the flicker while noticeable would not be annoying for limited projection.

The particular commercial projector we undertook to convert was the Keystone. Until recently, this machine was equipped with a three-blade shutter that interrupted the light three times per frame. More recent models have four interruptions per frame. At the right of Figure 1 are shown the two types of shutters used as original equipment. The three-blade disk revolves once per frame giving three light interruptions, and the one having two blades

(Continued on page 134)

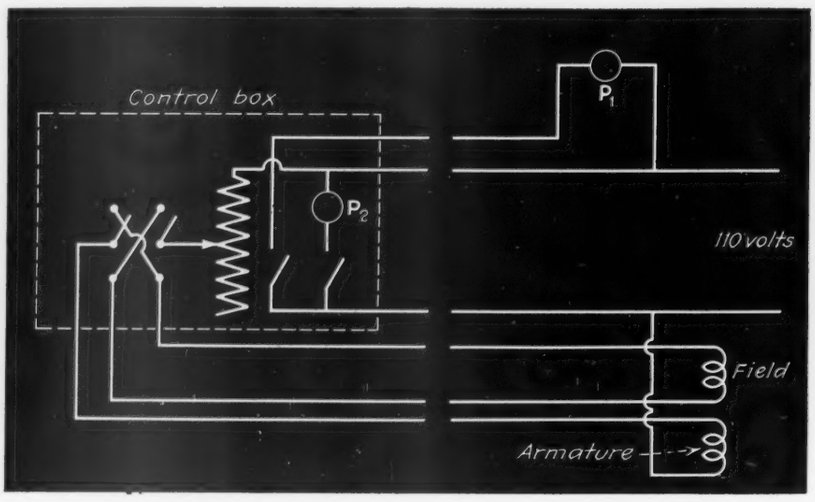


Figure 5. Wiring diagram for A-72 projector. P_1 is projector lamp, P_2 is pilot light

Management Shorts

Readers are invited to contribute brief articles, illustrated when possible, reporting out-of-the-ordinary management accomplishments. Accepted articles will be paid for

PRODUCTION PLANNING AND CONTROL

Scooters Save 25 Per Cent in Walking Time

SOURCE
R. G. Le Tourneau, Inc., Peoria, Ill.

Substantial savings in time have been accomplished by putting on wheels everybody who has much occasion to move about through the plant. Messengers, foremen, and others, are equipped with bicycles. But for those men who do the most moving through and around the quarter-mile long factory, gasoline-powered scooters are used.

The plant has nine of these autobikes: two for plant superintendents, four for stock chasers, one for the service department, one for the vice-president and factory manager, one for the president. The scooters reach a top speed of 30 miles per hour and can go 120 miles per gallon of gasoline. It is estimated that superintendents and stock chasers, who find it necessary to go from one end of the plant to the other many times a day, save up to 25 per cent in time, as compared with walking. An automatic clutch and gearshift make it easy to travel over grades, through sand, and over rough ground. Consequently the scooters are used almost as much around the plant and over the rough ground outside as they are used inside.

The little gas bugs are much smaller and more mobile than bicycles. Stock chasers frequently use them to carry small parts and tools to distant sections of the plant. Orders are not usually transmitted by scooter, unless the person issuing the order happens to be moving about on a scooter; telephones and bicycles do the routine work of handling orders.

Three years ago the vice-president saw the scooters in use for non-industrial purposes in Los Angeles and realized their possibilities for his plant's problems. Since they have been in use, nobody at Le Tourneau knows how we could comfortably get along without them.

Scooter-mounted Le Tourneau executive stops to talk things over with the boss

•

Save $990 by Giving Each Man His Own Drills

R. NORTMAN AND W. HANSEN
Production Engineering
Harley-Davidson Motor Company
Milwaukee

By handing out 33 sets of fractional-size drills, 29 drills in each set, and 23 sets of wire-gage drills, 60 drills in each set, we are going to save $990 each year in time that has hitherto been wasted. Also, we have had returned to us $308 worth of drills that had been lying around our toolroom not being used.

Previous to the new system, each toolmaker had an assortment of drills in his workbench drawer, where he kept them "handy." However, in truth they weren't so handy, because after a new drill is used once or twice the shank becomes scored and marred, so that the size stamped on the shank is not discernible.

Each time the toolmaker wanted a drill he "miked" three or four to get one of the size he needed. More often than not, if he didn't find the right drill after "miking" three or four, he gave up in disgust and walked to the tool crib to get the drill.

Our 33 toolmakers use an average of 8 different drills each working day. Fractional sizes vary from $\frac{1}{16}$ to $\frac{1}{2}$ in. in graduations of $\frac{1}{64}$ in., and wiregage drills from No. 1 to No. 60. A fair estimate of the time necessary to find a drill, or to get it from the tool crib, is one minute: If each man uses 8 drills in a day, total time wasted getting drills each day will be $1 \times 8 \times 33 = 264$

min. With approximately 250 working days in a year, yearly waste is 264 × 250 = 66,000 min., or 1,100 hours. Average hourly rate for these toolmakers is 90 cents, making a total cost for time wasted per year of $990.

Our solution for this problem was a set of drills for each man, held in orderly fashion in drill stands that have a place for each size drill, a place in which only that particular drill will fit. The toolmaker can pick out instantly the correct drill. He can also keep drills sharpened the way he wants them. Cost of these stands, fabricated of pressed steel, was only $16.

The toolroom foreman gathered in all the drills that were scattered around on benches and in drawers. These we used to make up the sets, buying new drills where necessary. However, the cost of the new drills must not be construed as part of the investment cost of the new system, because we would have had to buy them over a period of time anyway.

Drill replacement is the same as it was before. When a drill becomes broken or so short it can't be used, the toolmaker takes it to his foreman who orders a new one out of stock.

As this is written we are working on a plan to give each toolmaker a set of taps that are most frequently used. Wood blocks will be drilled to hold these taps.

PUBLIC AND EMPLOYEE RELATIONS

No Need to Guess Where the Stretcher Is

SOURCE

Norton Company, Worcester, Mass.

There is always the chance that some workman will be injured or taken sick and require handling on a stretcher. In order to make sure that a stretcher will be available, and easily located when needed, the one reserved for the wheel-truing department is kept in a centrally located, locked cabinet, as shown in the photograph. The key is kept in a small case with glass front, fastened to the door. When need for the stretcher arises, the glass is broken.

The cabinet is distinguished by a green cross painted on a white background, and its location marked by a green light, also cross-shaped.

It also serves as a convenient and well-marked place for locating a fire extinguisher.

•

A public address system, with 60 loudspeakers scattered throughout the plant, fosters closer contact between management and employees at the A. C. Gilbert Company, New Haven, Conn. Executives can speak to all employees at once, music can be played during working hours, and voice paging can be done.

•

Polled Their Customers About Saturday Closing

SOURCE

Fort Wayne Corrugated Paper Company, Fort Wayne, Ind.

We asked approximately 10,000 of our customers and prospective customers to tell us what their policies are concerning office and factory closing on Saturdays. Our curiosity started with a desire to grant our employees the full Saturday holiday each week, especially during the summer months.

Of the 9,000 questionnaire cards we sent out, 25.5% were returned with replies. The following are the questions asked and the returns:

Do you close your office all day Saturday? 60.8% said they do not, 39.2% said they do. Of the 39.2% who do close all day Saturday, 18% close during the summer only, 82% all year.

Do you close your factory all day Saturday? 35% do not, 65% do. Of the 65% who do close, 6% close during the summer only, 94% all year.

Do you interview salesmen on Saturday? 42% do, 58% do not interview regularly. Of the 58%, 40.8% do interview salesmen by appointment, 59.2% do not interview salesmen at all on Saturday.

Do you now receive materials on Saturday? 53.7% do, 46.3% do not.

If your corrugated or solid fiber box supplier closed its offices and factory all day Saturday, would it interfere with your operations? 1.5% said that it would, 98.5% said that it would not.

As a result of the returns from this questionnaire we have adopted a five-day week in our factories, and placed the offices on a five-day schedule for the summer.

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Certificates and Cash for Employee Suggestions

A. A. ANDERSON
Tractor Works, Inspection Office
International Harvester Company
Chicago

The management of this plant has, for a number of years, sponsored a suggestion plan in which all employees are encouraged to participate. Only members of the executive organization and those directly involved in cost reduction work are ineligible for cash awards. The plan has proved highly successful inasmuch as numerous improvements in design and methods have resulted in real savings; at the same time employee interest has been stimulated.

Suggestion boxes similar to the corner mailbox are located at convenient stations throughout the shop, and "suggestion blanks" are always available at these stations.

The personnel department acts as a clearing house, directing the body of the suggestion through proper channels and retaining all other information, such as employee's name, as confidential. After all pertinent information has been accumulated, the suggestion is referred to a committee for acceptance or rejection, depending solely upon the merits of the idea.

Awards are based on originality and savings involved. A "Certificate of Award" is presented to the author of an accepted suggestion, and cash awards of from $5 to $100 are not uncommon.

FACTORY
MANAGEMENT and MAINTENANCE

JULY, 1939

Better Handling Betters Profit

EVERY PLANT IS IN THE HANDLING BUSINESS. Every plant faces the fourfold problem of (1) moving materials and supplies into the plant, (2) getting them to production lines when and where needed, (3) moving them through manufacturing processes, and (4) transporting finished goods away from production lines to storage or shipping.

Many plants are already doing an excellent job of handling. Yours may be one of them. But no handling job is so good it can't be improved. That is why FACTORY presents this special section on materials handling — its fourteenth annual treatment of the subject — with its keynote of "Better Handling Betters Profit."

We say *better handling betters profit* because when a company buys handling equipment it does not merely buy cranes, hoists, trucks, tractors, or conveyors as such. It buys instead the ability to conduct its manufacturing operations on a low-cost basis.

It buys shorter manufacturing cycles, lower inventories, quicker deliveries, better use of manufacturing space, steady flow of production, freedom from spoilage, improved quality, safety.

These are everyday goals for the men who operate plants in industry. It is by attaining these goals that the men in plant operation make their contributions to company profit.

To illustrate how *better handling betters profit,* we have chosen five representative plants, each doing a *good* job of handling, and each with a *different* job to do. The five plants and the reasons for choosing them are briefly these:

1. *Ternstedt Trenton Division* of General Motors Corporation. A single-story plant making 787 different items, all on a mass-production basis. Uses a wide variety of mobile equipment to move raw materials to production lines, also to transport finished goods away from the lines, and an equally wide variety of fixed equipment to move parts through production.

2. *The Pepsodent Company.* Also a single-story plant, but making only three products,

Not the only way to handle paper stock, but certainly the "one best" way for the job in hand because the multi-lift elevating platform truck enables this concern to take full advantage of that valuable space "up under." Note angle at which bundles are piled; truck can maneuver in less space, thus less storage room has to be sacrificed for aisles

each in four sizes, all on a mass-production basis. Production so standardized that it uses a fixed equipment to do the entire handling job, which is unusual in that the biggest part of it consists of moving cartons and other supplies to its fourteen production lines.

3. *Easy Washing Machine Corporation.* Single-story operation. A single product. Description confined to final assembly, which has been newly conveyorized and provides good example of how production may be doubled, even trebled, in the same manufacturing space.

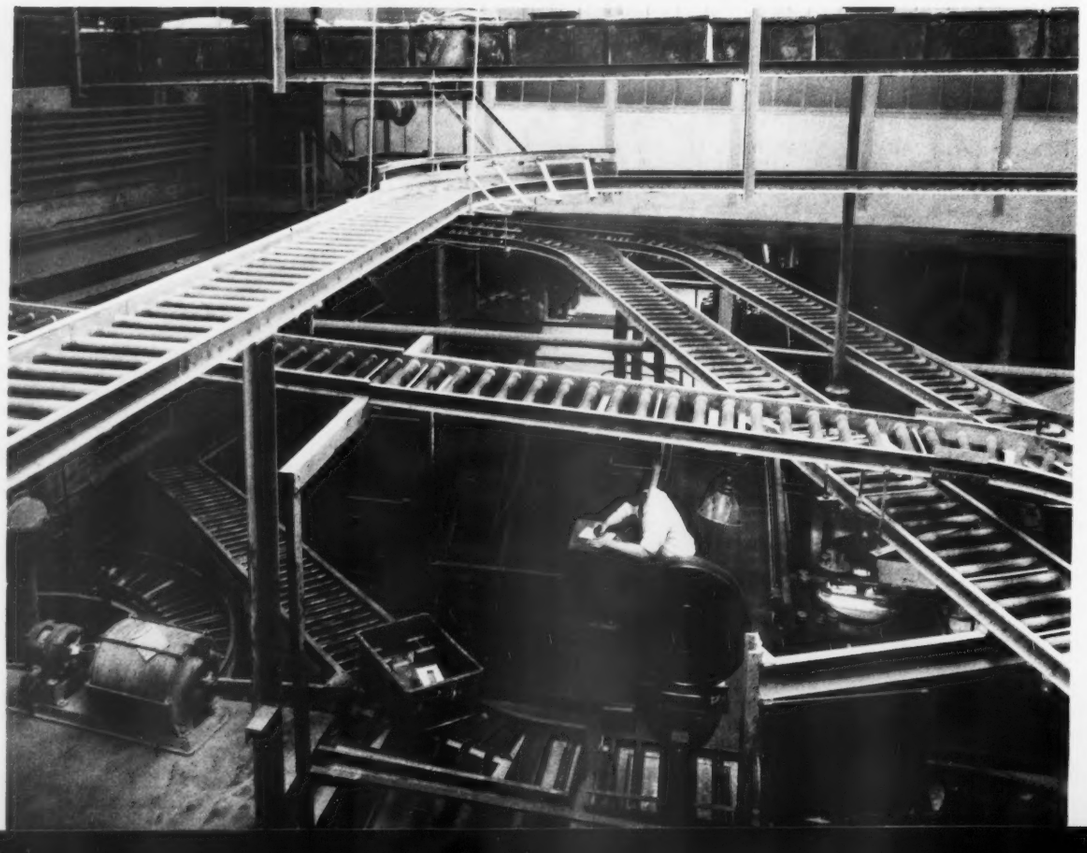
4. *The Standard Register Company.* A two-story plant. In an industry generally conceded to do a mediocre job of handling. Job begins on the ground floor, is completed on the second. Mobile equipment used to bring materials to presses; fixed handling equipment to convey the work through production processes.

5. *McKesson & Robbins, Inc.* A multi-story plant. Makes several hundred items, some in small quantities, others in mass production, all in straight-line flow. Uses mobile equipment to handle raw materials and finished goods, fixed equipment to move products through processes. Takes advantage of multi-story construction to use gravity wherever possible.

Most kinds of equipment are found in these five plants. But of course no five plants could have been chosen that would include everything now offered by the equipment makers. Nor every handling job that has to be done. For this reason we have concluded with a brief section headed, "No Matter What the Product." It is made up of actual installation pictures of types of equipment or jobs not shown in the five selected plants.

What these plants have done, other plants can do. It is indeed because every plant has this handling problem and because every plant can do something about it that we offer this special 24-page section. It is all in the interest of lower-cost production. It is all by way of pointing out ways and means by which manufacturing industry can — *at a profit* — turn out more and more goods at prices more and more people can afford to pay.

May look intricate, but isn't. This maze of conveyors works simply and efficiently because its component parts are coordinated to form a "system" in the sense that a great railroad is a system. Installation includes live roll conveyors, gravity rolls, scale sections, vertical elevators, "Y" sections, and switches. It connects various processing operations in the plant of a manufacturer of rubber belting and other rubber products



Adjacent to unloading docks is the raw materials storage area, 75x920 feet, served by a 10-ton crane. At left, one of the many chain hoists used to handle materials, such as sheets, strips, or coils, to machines at beginning of various production lines

★ BETTER HANDLING BETTERS PROFIT ★

Ternstedt Trenton Division

GENERAL MOTORS CORPORATION
TRENTON, N. J.

OUTSTANDING among industry's plants where *better handling betters profit* is the Ternstedt Trenton Division of General Motors Corporation whose 900,000 square feet of floor space is devoted exclusively to the manufacture of automobile body hardware and fittings for shipment to Eastern and Southern assembly plants.

Here indeed is a plant built around the handling business that is carried on within its four walls. Flow of materials is, without exception, straight line and moves from the receiving and raw materials storage area at the western end of the plant through manufacturing departments to the warehouse and shipping platform at the eastern end.

Adjacent to the unloading docks is the raw materials storage area, served by a 10-ton crane. To insure continuity of production at all times and under all conditions, a month's supply of raw materials can be stored in this space. Across the plant, at the eastern end, is the warehouse where, to insure a continuous flow of parts to assembly plants, it is possible to store 18½ days' production, or 46,250 complete sets of hardware. This also permits the rotating of parts on the various production lines.

Approximately 787 different items have to be made and assembled to provide the hardware needed for a single body. Plant and equipment are therefore laid out so that similar parts may be fabricated on the same lines. There are four departments in the main manufacturing area: (1) The mechanical hardware department which produces window regulators, seat adjusters, locks, hinges, and similar parts; (2) a department that makes rolled sections, including sash and garnish moldings; (3) one devoted to the manufacture of parts for the no-draft ventilation system; (4) the die-casting department which makes door handles and other fittings.

To insure steady straight-line flow, a wide variety of mechanical handling equipment has been provided. This equipment is of both the fixed and mobile type, the two kinds being everywhere coordinated to make a "system" in somewhat the same sense that a great railroad is a system.

Fixed equipment includes cranes and hoists, belt, roller, apron, and overhead chain conveyors, as well as chutes and slides of many types and sizes. Mobile equipment consists of fork trucks used in combination with pallets and skid platforms, tractors and trailers, three kinds of portable hoppers, and special all-welded floor trucks designed to handle steel in various forms.

In general, raw materials are moved to production lines, and finished products away from production lines, with mobile equipment. Listed in this class we find three 3-ton and three 1-ton telescopic tilting fork trucks, and four gas tractors. The 3-ton trucks are used mainly to handle steel, the 1-ton trucks for lighter loads. The tractors are used

principally to haul finished goods away from production lines, also scrap from machines. Both tractors and 1-ton trucks cover regular routes, thus provide transportation not only *where* needed but also *when* needed. In general, the first job of the 3-ton fork trucks is to disburse the day's supplies of materials to production lines; they are then free to handle inbound freight.

To illustrate how this mobile equipment teams up with fixed handling equipment to form a well-coordinated system, we shall do well to pick out typical but widely differing products and follow them from the raw materials storage area through the fabricating lines and on into the warehouse at the opposite end of the plant.

We can start with the window regulator, which is typical of products made in the mechanical hardware department. Stock for one part of this assembly comes in coils on wooden skids, is moved to the head of the production line by one of the 3-ton fork trucks. Here the coil is up-ended and placed in feed position in a cradle for the cut-off operation. Pieces drop from the press to a short section of inclined belt which dumps to a slide, which in turn delivers them at the front end of the next press. There are three more machines in this section, and in each case the move is made as just described. The familiar tote pan is thus done away with at this operation as well as everywhere else in the plant.

But to get back to the window regulators, they are racked at the end of the machine line, hung on an overhead chain, and taken directly to the automatic degreaser and into the black enameling machine. Emerging from this operation, the racks are picked off the line and transferred either to a storage monorail or to a belt conveyor which moves them through final assembly operations.

By Tractor and Trailer Train

From this belt conveyor the finished window regulators are packed in shipping cases, and placed on a trailer. The load is now ready to be hauled to the warehouse by the tractor that covers that territory.

Garnish moldings for windshields, the second product we shall follow, are typical of the parts made in the department that produces rolled sections. This molding is made in two pieces, the upper portion and the lower portion or trim panel. The upper portion is made from coil stock, which is moved to the point of use in the same way that the raw material for the window regulator was handled. First it is rolled, then cut off, the pieces sliding down to left or right benders, after which it is hung on a monorail and taken to a fabricating line of perhaps a dozen presses.

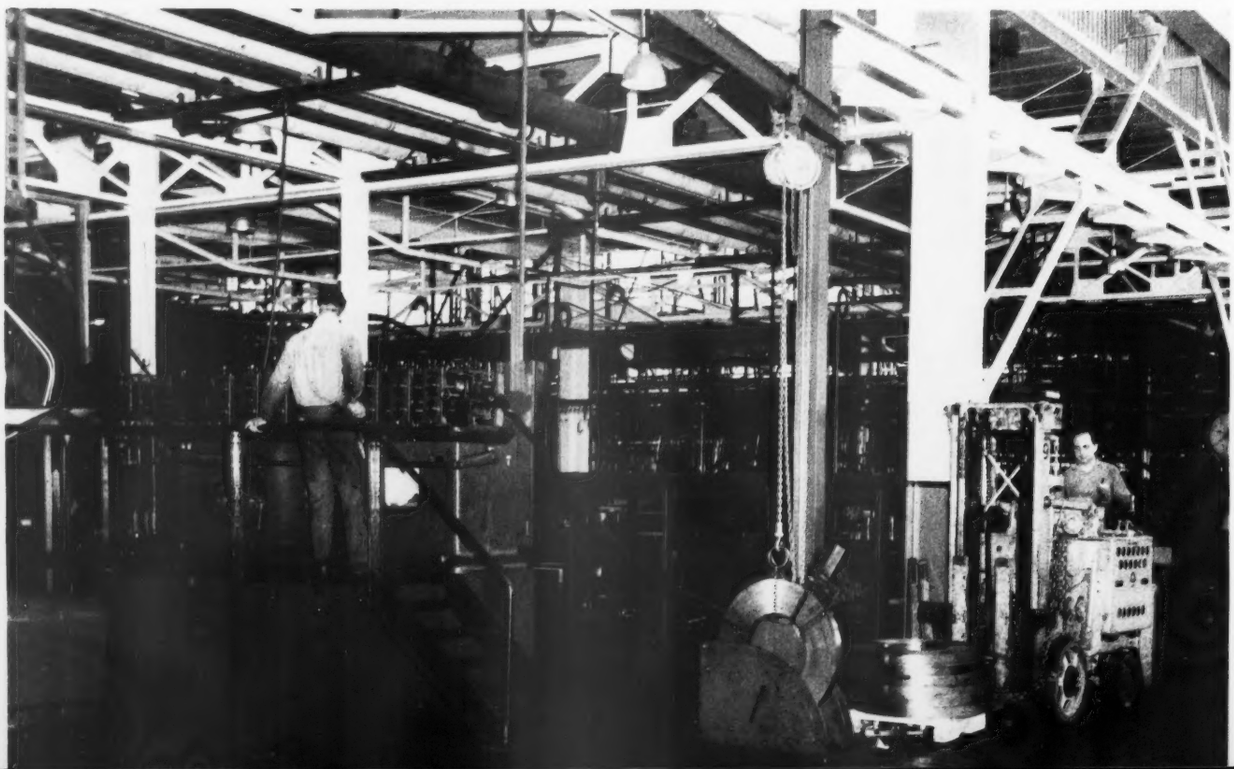
Here special pipe rail slides are used to move the rather large and hard-to-handle part from one machine to the next. These slides are all-welded, adjustable for length as well as height of either end. They are also portable and can be shoved into place or out of the way at will.

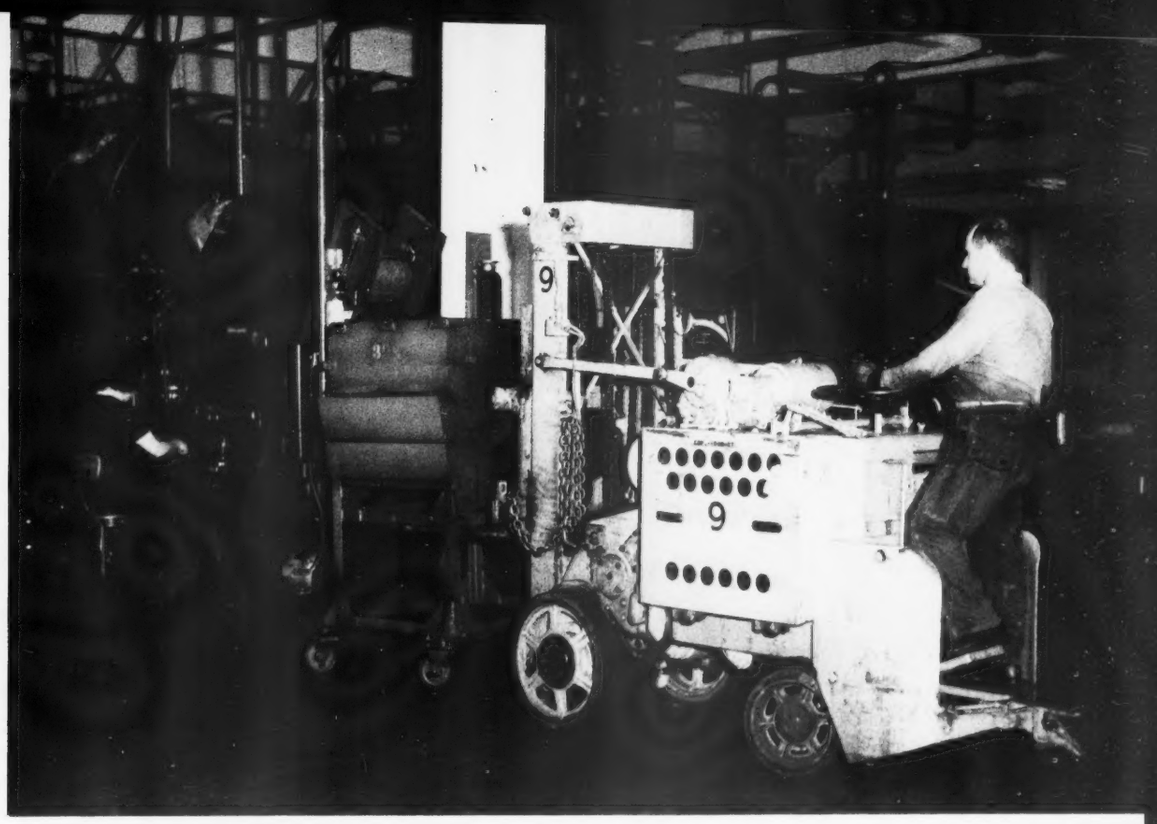
Sheet-steel stock for the lower portion or trim panel is received in steel-strapped packages on skid blocks, is brought from storage via fork truck. The sheets are placed on a gravity roller conveyor, on which it is moved through a shaping and a drawing operation.

At this point the part must be moved through a line of six machines, and for this handling job Ternstedt has again selected equipment especially suitable to a part of this size and shape. It is in effect a narrow greased trough-like slide with guide rails to keep the part in an upright position. As each machine operator completes his job, he merely sets the part in the slide and gives it a quick shove which sends it over to the next man in the machine line.

The trim panels now meet the upper portions of the molding and the two parts are welded automatically into one and transferred to a monorail from which it is removed for automatic grinding and polishing operations, then

One of the 3-ton fork trucks delivers a skidload of coil stock to the press at the start of the line where the upper half of the garnish molding is fabricated. The ½-ton hoist on the jib is used to up-end coils and place them in feed position





In general, lighter loads are moved by 1-ton trucks. Here one of them is removing a hopper load of seat adjuster parts to the assembly line. More than 300 of these all-welded portable hoppers are in daily use. They are specially built to feed parts to production machines

Continued on next page

put back to be transported to the finishing department on the second floor over the warehouse.

After lacquering and baking, the moldings for deluxe models are striped. For this they are transferred from the monorail to two belt conveyors on which the striping is done as the parts pass the operator. Back they go now on a storage monorail, ready for final assembly, which is merely stitching on a piece of weather-stripping. For this operation the moldings are transferred to a belt conveyor from which they are easily lifted and as easily put back on again.

At the end of the belt the moldings are packed into cartons, 20 to a carton. The cartons are sealed and chuted to the warehouse below. Here the cartons are piled on pallets on trailers and moved to storage location, lifted from the trailer by means of a fork truck and put away in storage.

For our third product we have chosen a door handle because it is die cast, then nickel and chromium plated, hence passes through a quite different set of operations.

First, the die-casting machines are laid out in a U-shape and are served by a traveling crane which carries hot metal from the four melting pots to the small pots on the machines.

Our door handles slide from the die-cast machines to trim presses. The latter are served by belt and apron conveyors. The trimmings, such as gates and sprues, drop to an apron conveyor and are taken back to one of three hoppers over the melting pots. The handles, on the other hand, are trimmed and then placed in a special monorail carrier. This carrier has eight rows of hooks. The handles are placed in the two top rows. The first operator picks them off, performs his operation, puts them back on the third and fourth rows. This procedure is followed by the succeeding operators. At the same time the monorail is stepped up in height at each operation. The result is to deliver the work at the most convenient and least fatiguing work level.

On a Non-Stop Trip

Handles are taken off at this point and transferred to a straight-line buffing machine, whereupon parts are racked for nickel plating and put on a monorail which takes them up and through an automatic degreaser. Next move is a transfer to the continuous plating machine, after which the handles are racked on the carriers which are to take them through chrome platings. After this, they come off the monorail, are inspected for chrome finish, packed, and removed to storage.

A brief catalog of the advantages of mechanical handling as evidenced in the Ternstedt Trenton Division might include the following:

1. Mechanical handling conserves manufacturing floor space that would otherwise be required for temporary storage of materials and parts in or near production lines.

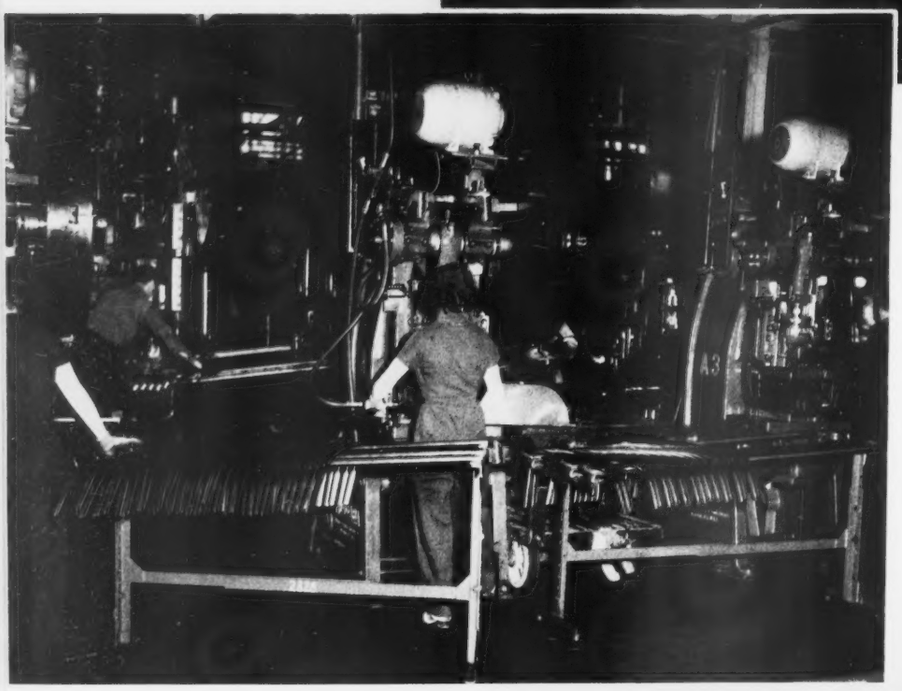
2. Insures a steady, rapid flow of materials and parts, thus reducing the manufacturing cycle and minimizing in-process inventories.

3. Increases production because productive workers do no handling, which adds nothing to the value of the product, but are free to devote full time to the productive jobs for which they were originally hired.

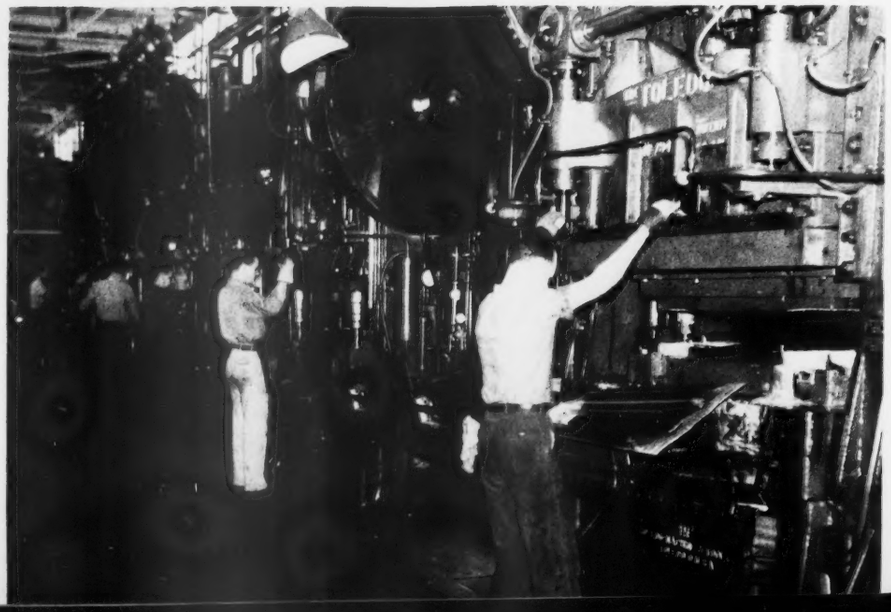
4. Delivers materials at convenient working heights, thus eliminating all unnecessary manual handling and lifting, and thereby minimizing fatigue and the spoiled work that inevitably results when people are tired.

5. Makes this a safer plant to work in because the hazards that go hand in hand with manual handling have been almost totally eliminated.

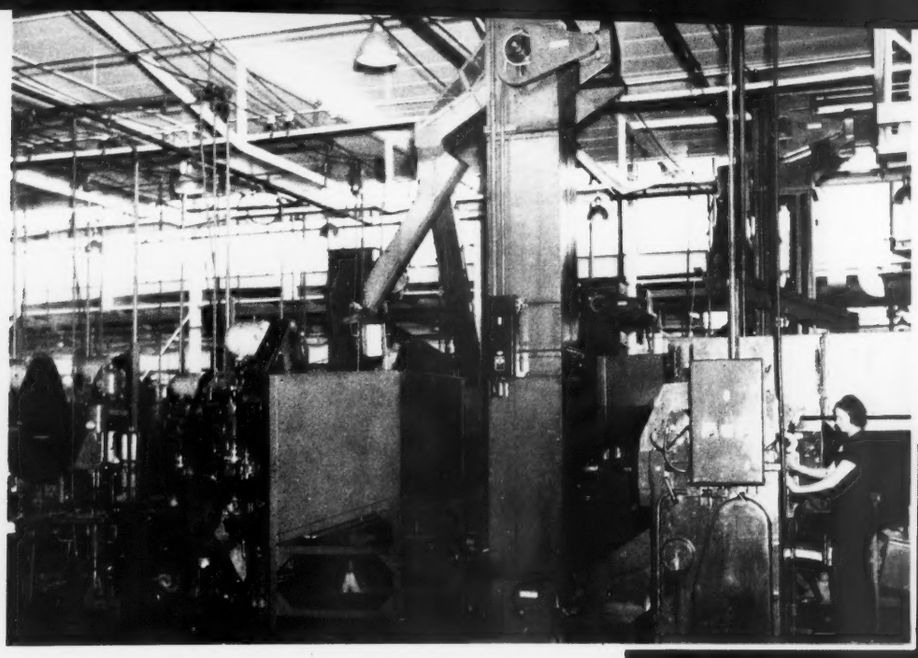
Flow from press to press in the seat adjuster fabrication line is of non-stop variety. Parts from one operation are elevated on the inclined belt and then chuted down and round to the machine operator at the next station



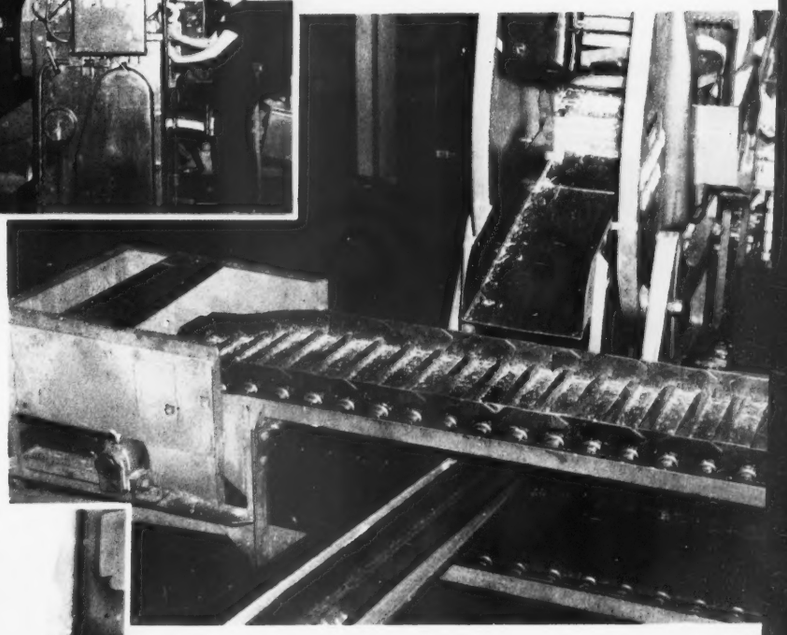
Left, a close-up view of pipe rails used to move garnish molding upper parts (also trim panels after they have been cut in half) from one production operation to the next. Note that the rails are both adjustable and portable



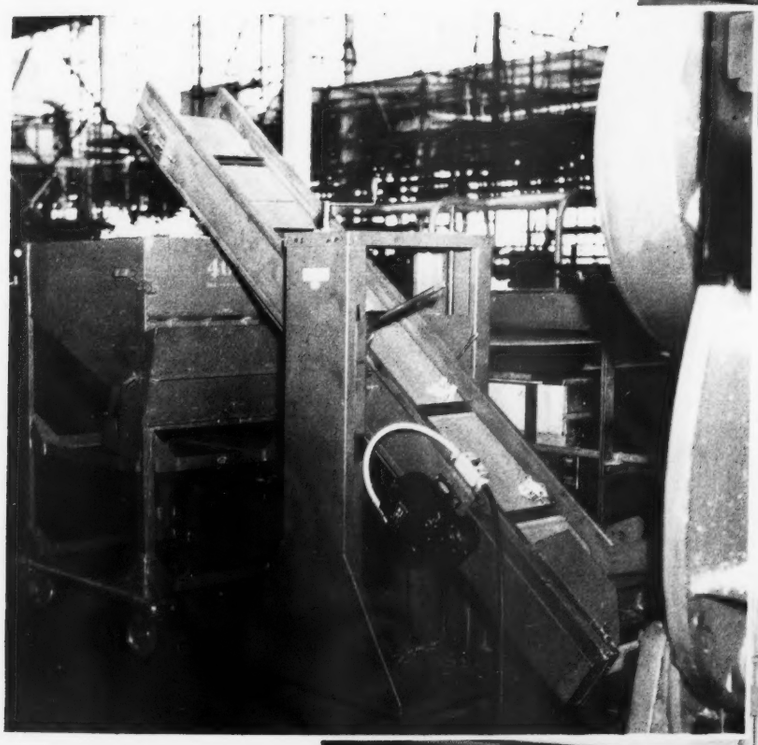
Before the garnish molding trim panel is cut in half, it is slid from machine to machine in the narrow greased trough-like slide shown here. It has guide rails to keep the part in an upright position. Just another example of how Ternstedt has chosen handling equipment to fit the particular job



Above, bucket elevator in door hinge line. Parts from drilling and reaming machine in the right foreground go up in the elevator, are chuted to the portable hopper, and then fed to the operator over at the left



Delivery end of multiple-trim punch press for die-cast hinges, showing apron conveyor carrying sprues and trimmings to remelt, and belt conveyor moving castings direct to machining operations in the hinge production line

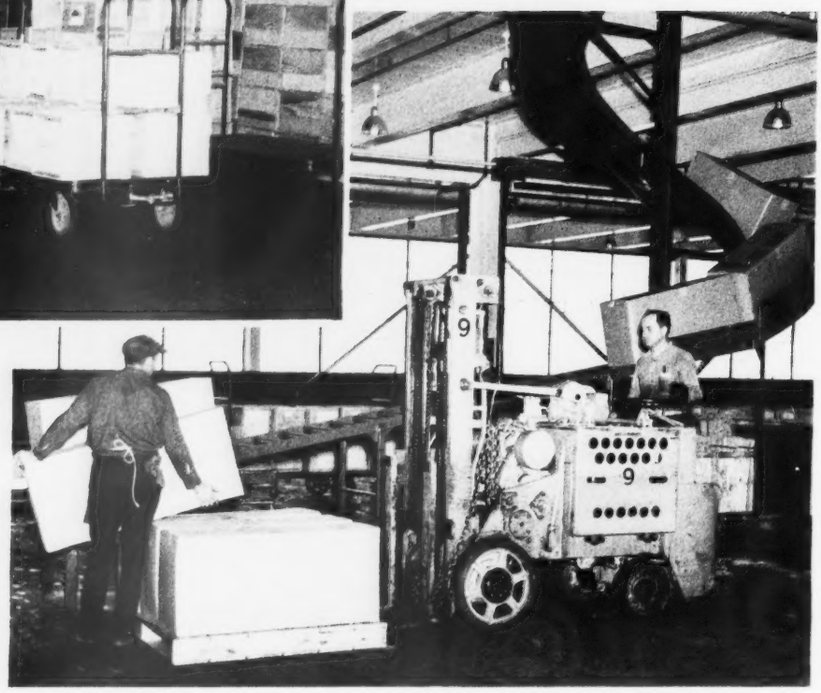


Left, adjustable portable inclined belt conveyor used with standard portable hopper to move controlled ventilation gear housings from trim operations in die-casting department to assembly

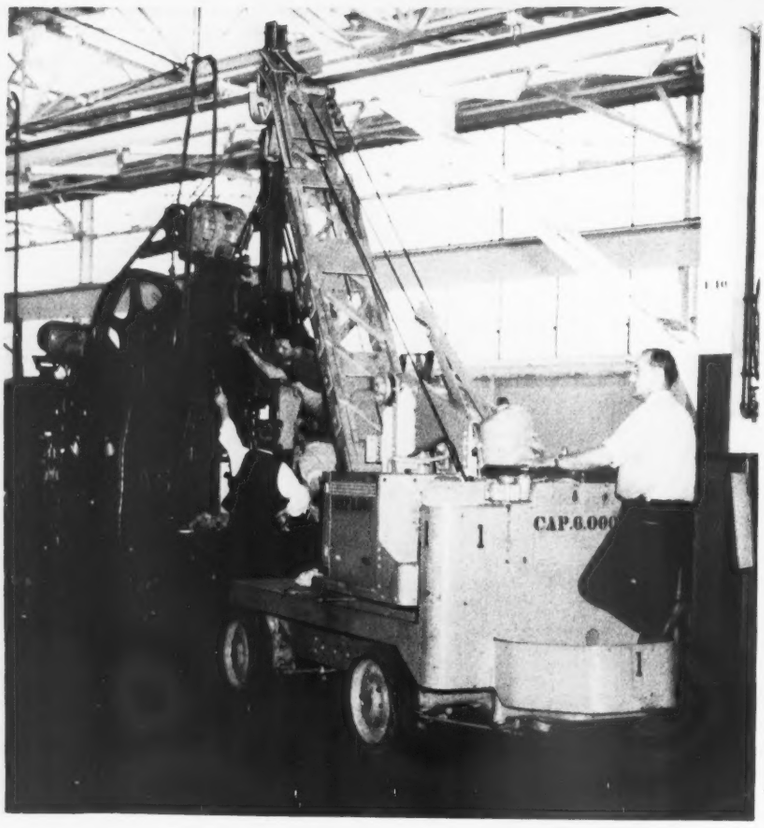
Continued on next page

Right, finished goods from production lines are moved away to the warehouse via tractor and trailer trains. Four of these gas tractors and some 150 trailers are daily used for this purpose

Parts are packed right at production lines; in this case it's door hinges. They are packed in wire-bound boxes, which are so heavy that an air hoist is provided to move them from the packing station to a trailer



Garnish moldings are moved from the fabrication lines on the first floor to painting and finishing operations on the second. Then they are packed and chuted to the warehouse, piled on a pallet, ready to be picked up by a fork truck and moved to storage



In days like these, when flexibility is so important, machines are moved around almost at the drop of a hat. Such move jobs require good, sturdy handling equipment; Ternstedt, for instance, keeps this 3-ton crane truck constantly on deck for just this type of handling operation. It finds plenty of work to keep it out of mischief

Unloading and loading platform at Pepsodent Company accommodates thirteen cars. Powder, the chief ingredient of two of its three products, comes in paper sacks, is unloaded to a portable belt and moved to storage

★ BETTER HANDLING BETTERS PROFIT ★

The Pepsodent Company

CHICAGO

FOR OUR SECOND EXAMPLE of the modern industrial plant where *better handling betters profit,* the Pepsodent Company has been chosen. When this plant was built, it was truly a case of erecting six walls around the processes, the two extra walls being firewalls to divide the plant in three sections—receiving and storage, fabrication, finished-goods storage and shipping.

Like the Ternstedt plant, Pepsodent is a single-story building. Like Ternstedt, it is a mass-production plant. But whereas Ternstedt manufactures 700-odd parts, Pepsodent turns out exactly three products. And they are as different from automobile body hardware as black is from white.

The three products are toothpaste, of course, toothpowder, and antiseptic, each being packaged in four sizes. There is a separate production line for each of the twelve sizes, two of the latter (10-cent powder and 25-cent paste) requiring two filling and two cartoning machines, thus making fourteen production lines all told.

Manufacturing processes with products like these are the relatively simple ones of mixing and packaging. Which means that Pepsodent's biggest job is handling — not so much the handling of raw materials as the moving of vast quantities of supplies from storage to production lines, and then the moving of cartons of finished goods away from the lines to storage or shipping.

Ternstedt, it will be recalled, moves raw materials to production lines with mobile handling equipment — power trucks, to be explicit. It moves materials and parts through processes mainly on fixed equipment — conveyors of a number of sorts. And it moves finished goods away from the lines again with mobile equipment.

Pepsodent, in contrast, uses only fixed equipment — as nice a combination of belt conveyors, gravity rollers, chutes, and slides as ever a plant operating man chanced to see.

Now, despite the magnitude of Pepsodent's handling job, it can be broken down like any other into four major operations: (1) Moving materials and supplies to storage, (2) getting them to production lines when and where needed, (3) moving them through manufacturing processes, and (4) transporting finished products away from the fabricating lines to storage and shipping

With Pepsodent, this is all a con-

tinuous job. An inclosed receiving and shipping platform, with room for thirteen cars, runs along one side of the building. Thus in winter cars are unloaded—and loaded—in tempered atmospheres, and raw materials and supplies are at all times protected from the weather. There are also two truck docks, one at one end for receiving, the other at the other end for shipping.

Three 175-ft. belt conveyors serve the receiving and storage area. When cars are unloaded, gravity roller sections are placed in position, and supplies are moved out of the cars by gravity to one of the power belts and across the room to storage. Supplies include cartons, tubes, bottles, caps, spacers, shipping containers, etc. They are naturally unloaded to storage areas convenient to the conveyors that are to take them to the production lines.

Of these latter conveyors there are 39, each designed to do a specific handling job. There are special conveyors, for instance, with cast-iron cradles to hold the bottles that must go to the four antiseptic lines. There are inclined belt conveyors to carry made-up shipping cartons to the lines. And so on. In all instances the conveyors start at working level, rise at once to ceiling height, thus adding to storage areas, and making full use of space up under the roof. Also, these same conveyors serve as storage banks at the production lines, again utilizing overhead space to the full and conserving valuable floor areas.

Two Men Keep Lines Supplied

Flow charts have been worked out to show how many tubes, say, or how many bottles to shoot to the production lines. Two men are thus able to keep the factory supplied with everything it needs.

Production lines consist of standard filling, capping, labeling, and sealing machines. Raw materials are stored, mixed, and processed in areas close to the lines, then pumped or conveyed pneumatically to hoppers at the individual filling machines.

Finished goods in shipping containers are chuted from the lines to a double-decked live roller conveyor which runs in a tunnel along the west side of the plant. Its movement is perfectly synchronized to receive packages from the ten dumps that serve the fourteen lines without a package ever sliding down a chute and bumping into a package on the conveyor.

This latter conveyor transports the packages to the finished-goods storage area, at which point they are moved up out of the tunnel, and automatically sorted by size to eight lines of live roller conveyors. From these conveyors they are picked off and piled. One man can comfortably handle the output of three manufacturing lines.

At the other end of the storage area is a double-decked belt. The upper belt takes packages to cars, the lower belt to the shipping room. Thus there is the sorting conveyor running along one side of the storage area, the shipping conveyor running parallel to it on the other side of the room, and the eight storage conveyors running at right angles to the other two and connecting them, thereby effectively covering every foot of the storage area and reducing manual handling to the simple tasks of lifting relatively light packages on or off conveyors.

One more point should be emphasized. There is the not inconsiderable problem of removing waste—the cartons, for example, in which bottles, tubes, caps, etc., reach the plant. To take care of all this trash, a 550-ft. belt conveyor rides in a trough beneath the receiving and storage area and the fabrication department. At strategic points in the plant there are chutes to cross conveyors which lead to the main waste conveyor. As bottles, for instance, are taken from the cartons and conveyed to the lines, the empty cartons are tossed into a nearby chute and taken via the waste conveyor system to a baling room at the end of the plant. Waste paper and boxes are baled separately, the income being enough to pay for what little other janitor work is required.

Powder storage. Bags are brought into the room via belt conveyor, then shunted off to this portable belt conveyor, whose end may be raised to convenient piling height

Biggest job at Pepsodent (below) is moving supplies from cars to storage, then from storage to production lines. In the foreground, one of the 175-ft. belt conveyors that serve the storage area. In back of it, three of the 39 conveyors that move supplies to the fourteen production lines. The shipping containers being made up by the attractively uniformed operator are headed for the 40-cent toothpaste line. Note how overhead areas are utilized for the supplies-moving job

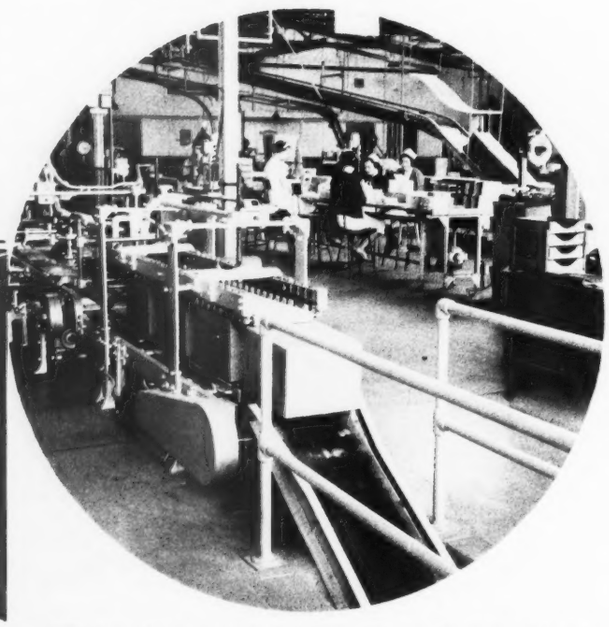
Above, toothpaste department. Powder from overhead hoppers is automatically weighed into the mixers. The elixir is prepared in tanks at the left. After mixing, the batch is dumped into the stainless steel cart, which is moved to a pump. The toothpaste is pumped to a storage hopper, then as needed to hoppers at the individual filling machines

Below, a section of the fabrication area, showing some of the fourteen production lines. Note the overhead conveyors bringing supplies to the lines, and acting as temporary storage areas. Despite the large amount of overhead equipment, this department with its roof monitors and its all-glass west wall is exceptionally well daylighted

Continued on next page

Close-up of 25-cent toothpaste line. Overhead, one of the conveyors that brings shipping cartons from the receiving and storage department. Really big job at Pepsodent is getting supplies to the fourteen production lines when and as needed. Two men keep the factory supplied with its requirements

Packages emerge from the tunnel on the sorting conveyor (below), are automatically sorted by height to eight power roller conveyors running at right angles to the sorting conveyor and connecting the latter to the shipping conveyor that parallels it on the other side of the department. From these eight conveyors the packages are removed for storage. The same conveyors take packages as needed to the shipping conveyor



Filled cartons are chuted from the sealing machine to a double-decked belt conveyor running in a tunnel along the west side of the building. There are ten of these chutes. Movements are timed so that a package never bumps into a package on the conveyor below

On the opposite side of the storage area, this shipping conveyor runs parallel to the sorting conveyor. Here one sees how the power roller conveyors connect the two and provide transportation from storage to shipping. The upper belt leads directly to a waiting car on the loading platform, whereas the lower belt moves packages to the shipping room. Note how the conveyor leading to the shipping room rises immediately to convenient working height

Easy Washing Machine Corporation

SYRACUSE, N. Y.

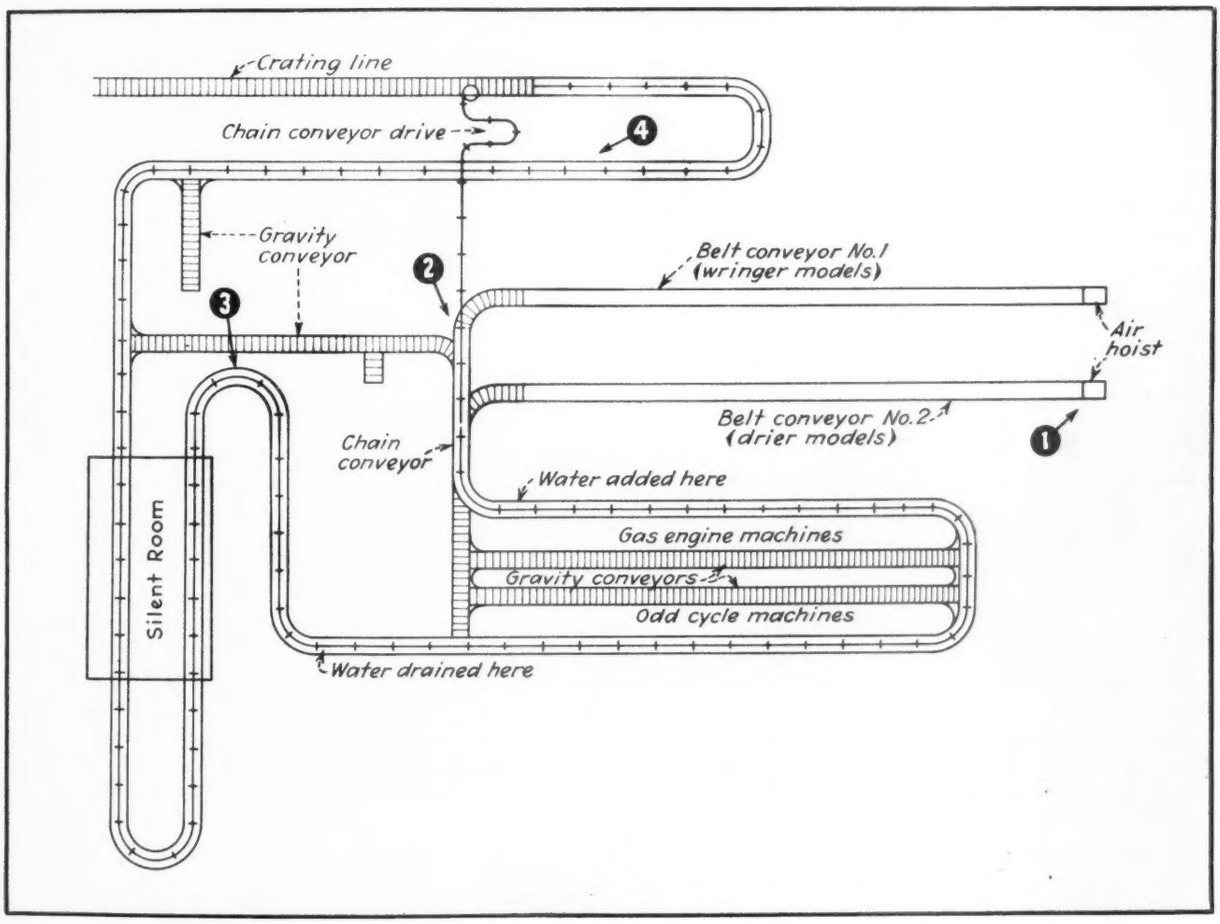
FOR OUR THIRD EXAMPLE of the plant where *better handling betters profit,* let us go to Syracuse, N. Y., to the Easy Washing Machine Corporation. And let us examine, not the complete handling job, as we have done in the two preceding cases, but only the final washer assembly line.

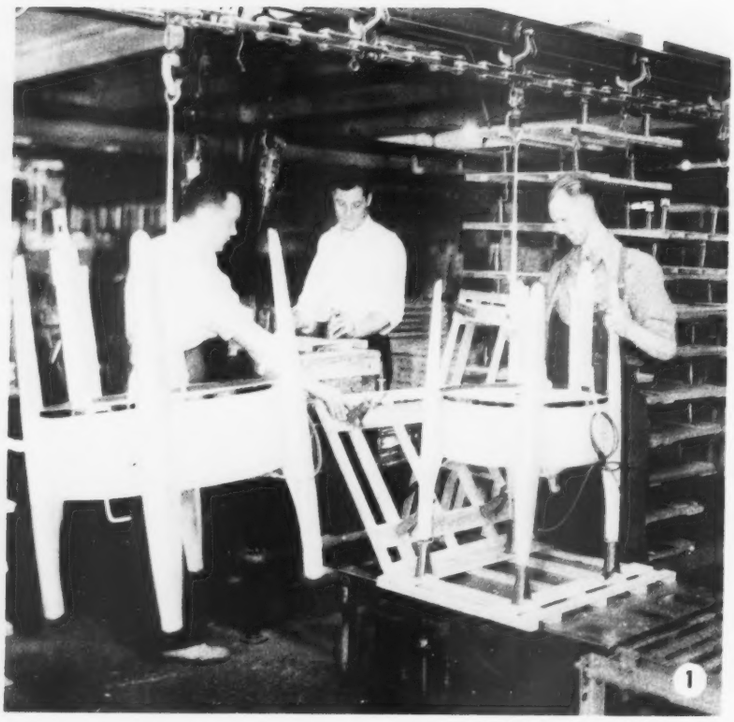
Let us do this because only within the year has Easy converted this part of the handling job from manual to mechanized operation. It therefore supplies us with an unusually good example of how the introduction of modern labor-saving equipment enables industry to turn out ever-better products for the same or less money—or, as in this case, more and more washing machines at prices more and more people can afford to pay.

This is not to imply that mechanized handling is anything new with Easy. Far from it. Traveling cranes, hoists, power trucks, overhead chain conveyors, gravity rollers, belts—these are everywhere in evidence, moving raw materials from cars to storage, from storage to production lines; handling work in process; transporting finished legs, skirts, and gear cases from production lines, through spraying, dipping, baking; carrying the same parts to their proper places in final assembly—and always getting them there at precisely the right time.

For a good many years Easy had

Below is a simplified diagram of the Easy final assembly department, showing how new conveyor has been fitted into available space. Numbers and arrows show where and in what direction photographs on succeeding pages were taken





Beginning of final assembly. Here the chassis, previously assembled, arrives from painting and finishing via overhead chain, is transferred by air hoist to the base of the crate, which is then slid to the power belt

been assembling washing machines on small carriers with casters on them. As each operation was performed, the machine was given a shove. It wasn't the worst way to do the job. It might even be a good way if it weren't for the fact that it takes a good many shoves to assemble a washing machine —and every shove is a chance to nick the enamel finish.

This is so true that Easy was in fact touching up one in every five machines. There was, indeed, a repair spray booth located in each of the two final assembly lines.

Another thing. Machines were given a running test under load for twenty minutes. But production flow was so irregular that some machines got more, some less. There was certainly nothing uniform about it.

Obviously the way out was to assemble on conveyors—to start with the bottom of the crate, build the machine on it, and wind up with the completely crated machine.

Simple enough. But not quite so simple as it seems, because Easy was not laying out a new plant. It had a certain fixed floor area available for final assembly, and the job was to fit the new conveyor into that space, which meant it had to turn corners.

The Sketch Tells the Story

But see the accompanying sketch. It has been purposely simplified to show only the floor conveyors and the line of travel through final assembly operations. It should not be difficult to imagine the various overhead lines — both chain and gravity roller conveyors—that bring tubes, covers, wringers, etc., to the lines when, as, and where needed. For further clarification the accompanying photographs are numbered; corresponding numbers and arrows on the layout sketch indicate the spot where each picture was taken and the direction the camera was aimed.

Briefly, it all starts with two belt conveyors, one for machines with wringers, the other for those with driers. Skirt, legs, and drive mechanisms, previously sub-assembled, are here received from enameling and baking via overhead chain. As seen in the first photograph, an air hoist is used to raise the crate bottom to the height of the machine on the chain conveyor. The operator unhooks the machine, lets it down, and slides it effortlessly to the power belt line.

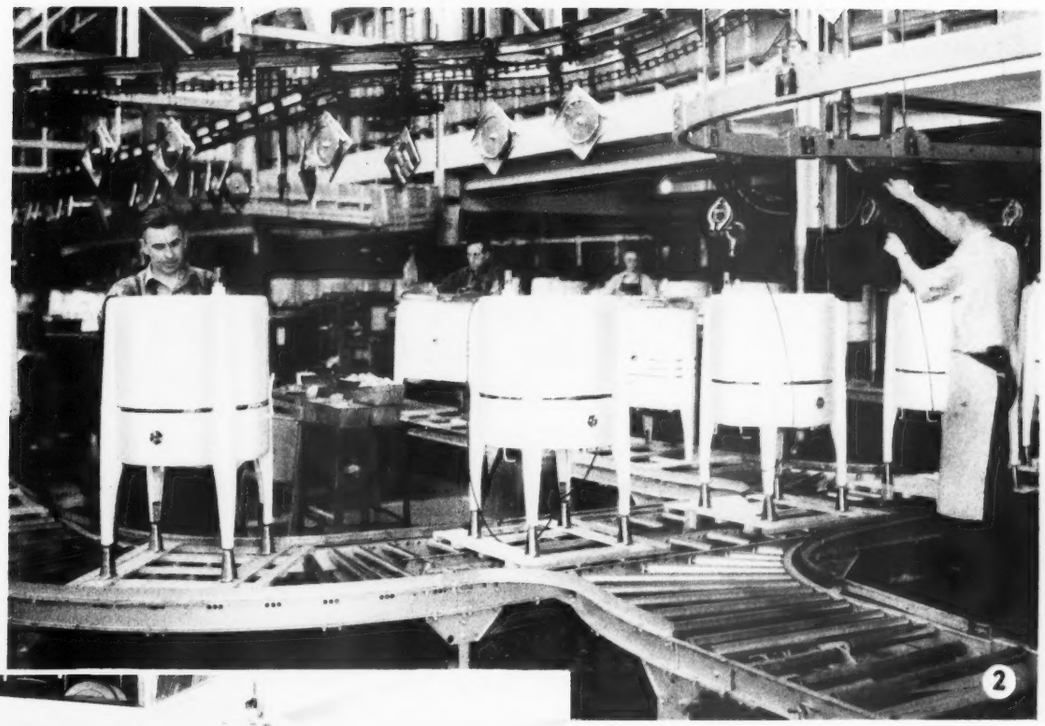
Tubs arrive at this point via overhead gravity rollers from storage on the mezzanine. The tub is assembled to the chassis, three or four other operations are performed, and by that time the machine has reached the transfer point at the end of the belt.

From this point on—see the second photograph—the machine moves on a pusher-type roller conveyor. The rollers are split, and under the slot thus created there is a chain with a pusher bar every 4 feet. It is simply an overhead chain conveyor, only upside down and under the floor. The drive mechanism is also under the floor and out of the way. Since the pusher chain can turn corners as easily as it can go straight ahead, the result is, in effect, a power roller conveyor that is not limited to straightaway movements.

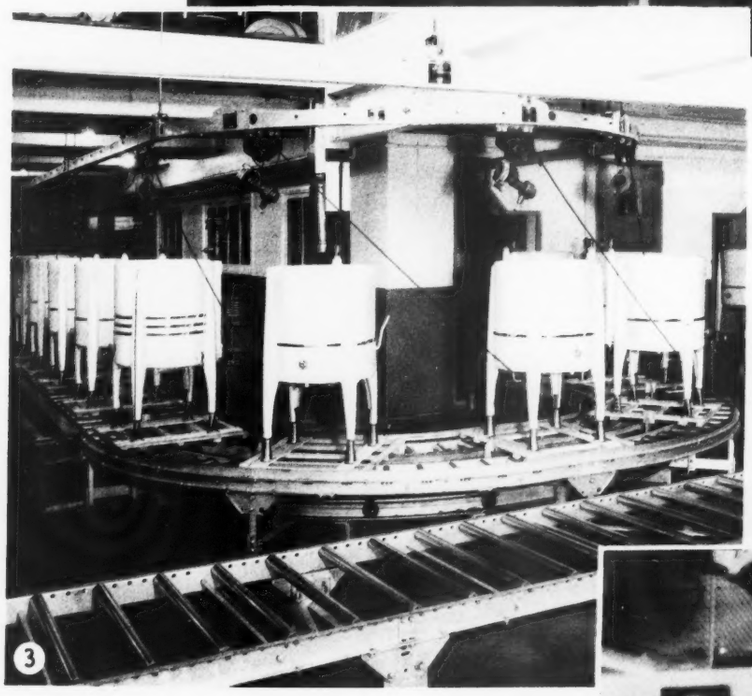
The sliding transfer from belt to pusher conveyor is made manually because there has to be a man at this point to hook the machines to the overhead power line. There is now a running test under load, then the machines move through final testing in a sound-insulated room.

There remains only the addition of agitator, cover, wringer, equipment box, etc. The pusher bars then disappear under the floor, and the journey through crating operations is made on dead rollers. After crating, the machines move direct to a power slat conveyor which leads to roller conveyors extending along the loading dock to freight cars.

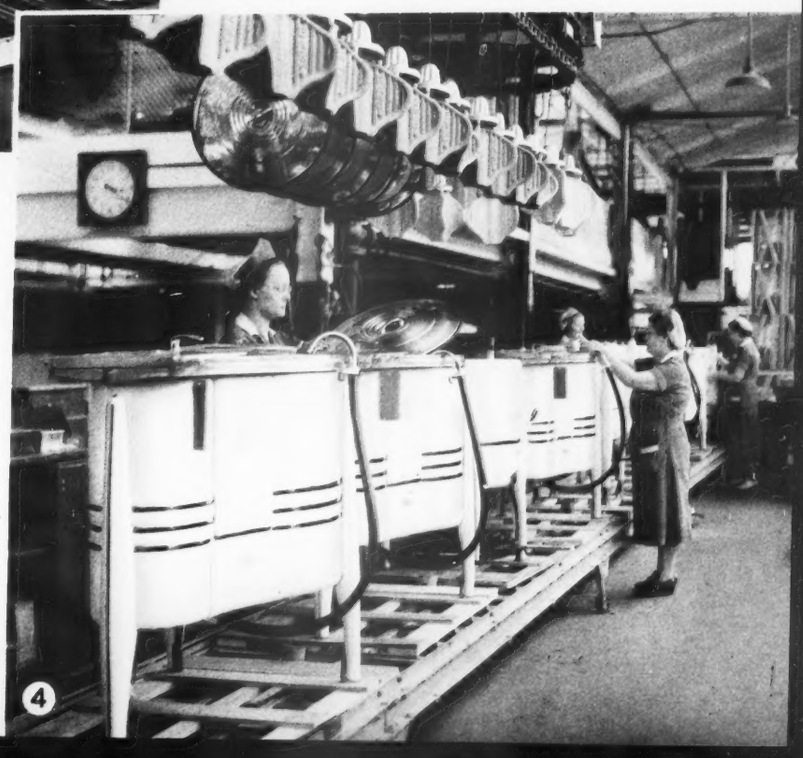
Some of the advantages of this mechanized assembly have already been noted—no shoving, hence no damage and a better product—regularized flow of work, hence uniform tests. Equally important, however, is the more effective use of floor space, and the extreme flexibility of production now achieved. The day this story was written, production was at the rate of 86 an hour. It can be stepped up to 150 by simply taking on more men, splitting up jobs, and so forth. Easy Washing Machine Corporation is all set for that emergency when it comes.



At this point (above) the assembled machine leaves the belt, is transferred over gravity rollers to a pusher-type roller conveyor. A chain with a pusher bar every 4 feet does the moving from now on. Here also the machines are hooked to the overhead power line for their 20-minute running test under load



Left, the machines at the end of the running test are still on the pusher-type roller conveyor on which they started their journey through final assembly, are now about to move into the soundproofed room for final tests



Toward the end of the trip through final assembly. Note overhead chain bringing gyrators and covers to the line exactly when and where needed. The machines are still on the crate base, are about ready to have the crate dropped over and nailed down, after which they proceed uninterruptedly either to storage or direct to freight cars

★ BETTER HANDLING BETTERS PROFIT ★

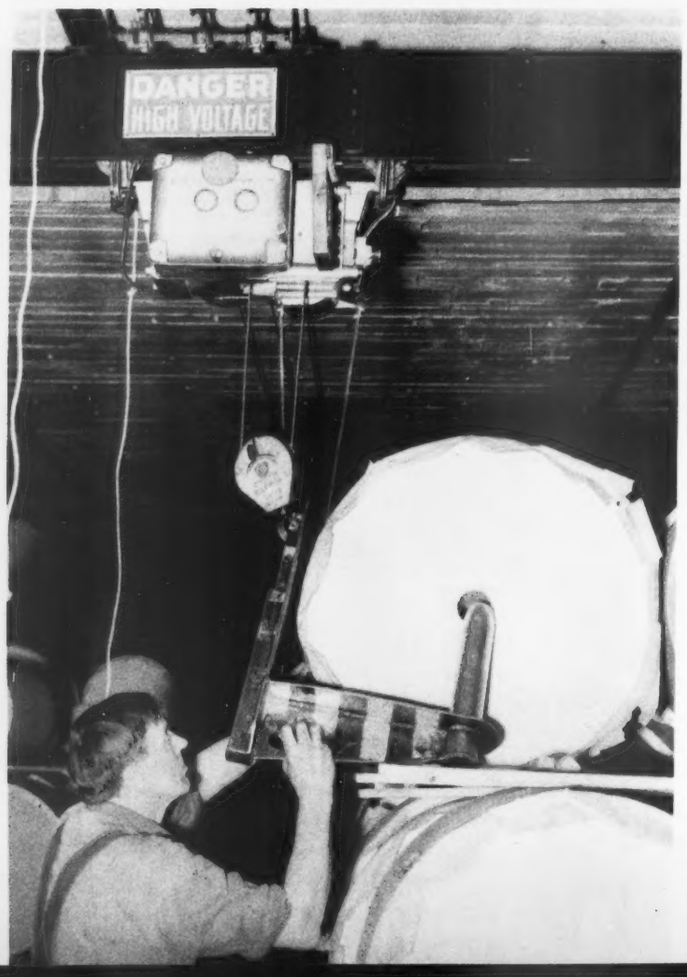
The Standard Register Company

DAYTON, OHIO

FAR UP ON THE LIST of industrial plants where *better handling betters profit* is The Standard Register Company, manufacturers of distinctive marginal punched business forms. Here modern equipment has: (1) Conserved floor space, (2) insured the steady flow without which mass production would be impossible, (3) minimized in-process inventories, and (4) made the plant a better one to work in. All these make for low-cost production; may therefore truly be said to increase profits. The results have been attained through the successful teaming of such widely differing types of handling equipment as cranes, power trucks, floor trucks, monorail, automatic elevators, pallet, belt, gravity roller, and overhead chain conveyors—all welded into an integrated whole.

Handling begins here with the moving of rolls of paper. The problem is to get the rolls to storage and out to the pressroom as needed, then to move the printed forms from the presses to the collating department on the second floor and on into the shipping room, at the same time bringing together boxes, cartons, and other supplies when and where needed.

First handling job at Standard Register is moving rolls of paper from cars to storage and then from storage to pressroom. This is done by teaming two half-ton cranes with a high-lift platform truck. The two cranes operate by means of switchovers in all three bays of the storage area, thus work without interference. Rolls are stored three or four high. Note special hook designed for this special job



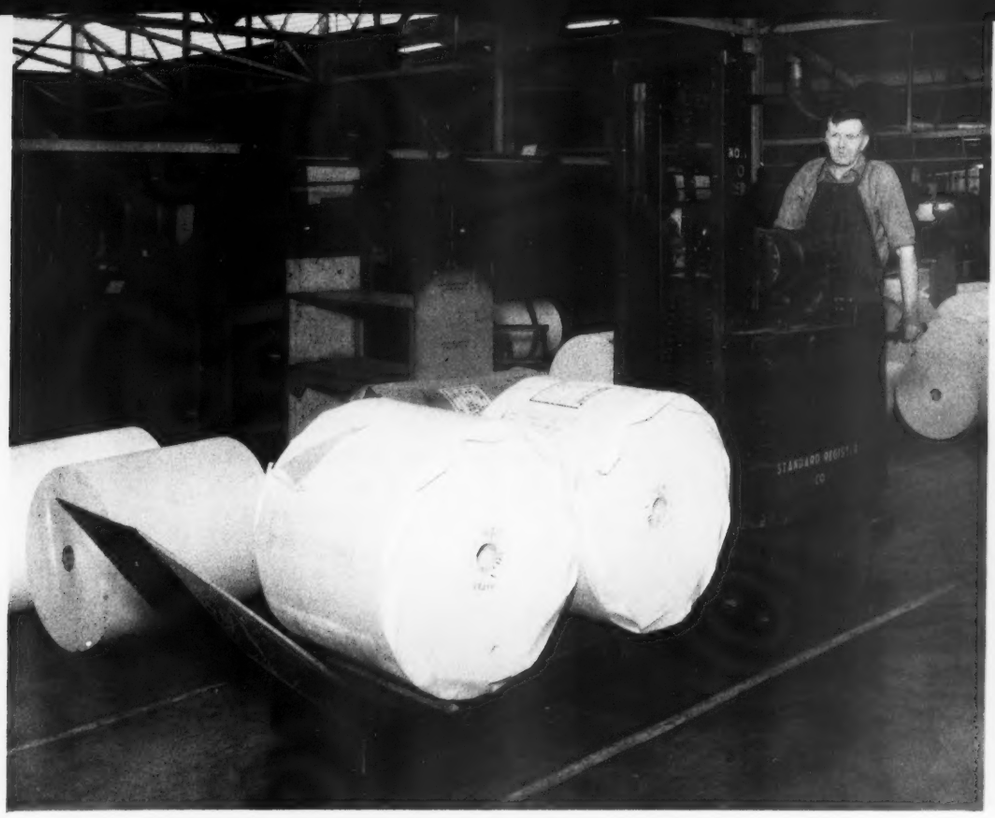
Part One of the problem is solved by teaming a couple of half-ton cranes with a high-lift platform truck. The two cranes operate by means of switchovers in all three bays of the storage area, which is quite naturally adjacent to the car-unloading platform. Rolls are simply rolled across the scales and picked up with a special hook designed for the job. Rolls are stored three or four high as required. Because of the switchovers at each end of the area, the two cranes can work without interference. One can unload a freight car, for instance, while the other is moving rolls to the pressroom.

Part Two of the handling job is to move printed forms to the collating department upstairs. This is done with special floor trucks, a monorail system which serves the entire pressroom, and a one-way automatic elevator. A similar elevator is also used at the other end of the collating department to return empty floor trucks; it works both ways, however, being also used to move carbon paper to collating.

Pallets Are Slid to Shelves

The floor trucks are constructed of angle irons and flat steel strips, with rods bolted through the framework to make shelves. Forms come off the presses directly to wooden pallets and the loaded pallets are simply slid onto the above-mentioned shelves.

A monorail serves the entire pressroom, and special carriers have been designed to pick up loaded floor trucks and move them safely to the automatic elevator. Each carrier has two eyes, and each floor truck has two lugs that fit



To move rolls of paper to the pressroom, the cranes team up with a power truck. A roll is simply deposited on the platform, whereupon the truck carries it away, either directly to a waiting press or to another storage area (for fast-moving materials) immediately adjacent to the pressroom. One man and one power truck are easily able to keep a continuous flow of materials from storage to production machines

Continued on next page

into the eyes. The carrier is then locked into a rigid upright position by means of a lever and is propelled by hand power to the elevator. Nothing would be gained by mechanizing this part of the job. Whether mechanized or not, it takes one boy to keep the presses supplied with floor trucks and to move the loaded trucks to the elevator.

Part Three of the job is to move the forms through collating and packing operations and on into the shipping department. Loaded floor trucks from the pressroom are discharged from the automatic elevator directly to a monorail which runs down both sides of the collating department. One branch serves a line of 22 machines on which carbon interleaved forms are collated; the other, a line of 7 machines for register forms which are not interleaved with carbon paper.

Between the two lines of collating machines runs a 400-ft. pallet conveyor. Work is discharged from the collating machines to metal pallets, and these pallets as loaded are slid from the tables of the machines to the moving pallet conveyor. Small wheels on the top side of the conveyor make this transfer job an easy one; pallets slide on almost too quickly.

Along the pallet conveyor are 24 packing and inspection stations. One man watches it and moves trays off when and where needed. A little transfer car runs along one side of the conveyor, enabling him to make another easy sliding job out of this transfer.

A little problem now rears its ugly head. How to get packing supplies to these packing stations? How to be sure the packer has the right kind of materials for the order in hand? This nut is neatly cracked by bringing in the necessary supplies on an endless cable conveyor which makes a circuit of the packing stations and carries everything the operators need. It has special carriers designed to fit various types of supplies, such as cartons, corrugated board shims, stapling wire, tape, notices, printed forms, inspection slips.

A "Seventh Inning" Stretch

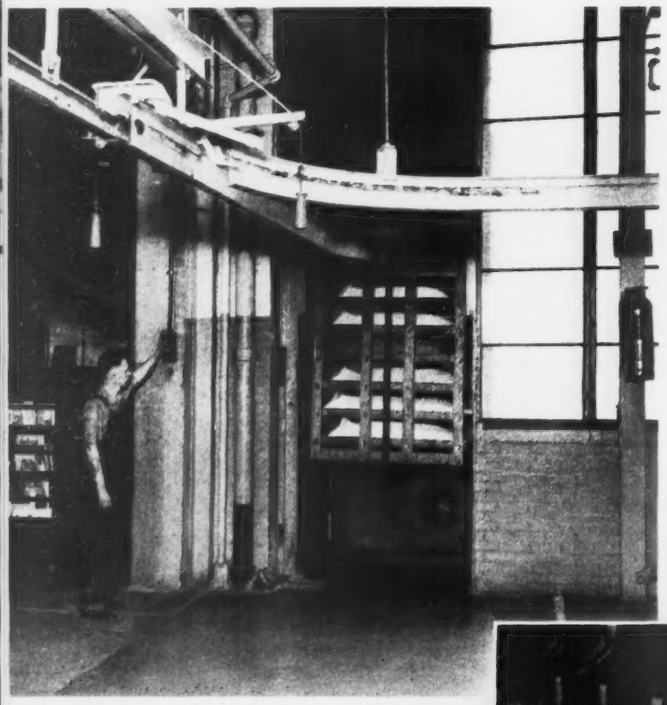
When an operator needs something —more cartons, say—she merely stands up and lifts a bundle off the moving stockroom. Now when that empty hook passes through the supplies storeroom in the far corner of the department, the stock man has simply to hang on another bundle. Thus one man keeps the conveyor loaded and the operators continuously supplied with their materials.

The first half of the packing line is for the register forms without interleaved carbon. The second half is for the interleaved form product, many of which go through certain other operations before being ready for packing. In either case the packed forms, still on the pallets, are slid back on the pallet conveyor and moved down to the end of the room, there to be automatically transferred to a belt conveyor which runs at right angles to the pallet conveyor and moves the loaded pallets into the shipping room.

Here the pallets are transferred to any one of the eleven gravity roller assembly conveyors which run across the room. Pallet loads are held on these conveyors until orders are complete and ready to be shipped. At the other end of the assembly conveyor is the outgoing shipping conveyor. The shippers are served, just as the packers are, by a "moving stockroom" which delivers supplies to them exactly where and when needed. In addition to shipping supplies, this endless chain also brings in anything special that is to go with the orders—things like Registrator platens, autographic registers, carbon rolls, and binders.

Orders are now weighed and routed, then moved to a shipping bank composed of fifteen gravity roller lines—one or more for each carrier. At the end of the shipping bank another roller conveyor leads to a power belt, which in turn leads to any one of three truck stations on the loading platform below.

Below, an automatic elevator moves printed forms from presses on the first floor to the collating department on the second. Here a loaded floor truck is coming off the elevator directly to the monorail which runs down both sides of the collating department. One branch serves a line of 22 machines on which forms interleaved with carbon are collated; the other one, a line of 7 machines for register forms



Special floor trucks (above) serve presses. They are made of angle irons and flat steel strips, with rods bolted through the framework to form shelves. Printed forms come off the presses on wooden pallets which are simply slid on these shelves. A monorail covers the pressroom, and special carriers have been designed to pick up the loaded floor trucks and transport them to the automatic elevator

This 400-ft. pallet conveyor runs between the two lines of collating machines. Work is discharged from the machines to metal pallets, and the pallets as loaded are slid from the tables of the machines to the moving pallet conveyor. Small wheels on the top side of the conveyor make this transfer an easy one. Along the pallet conveyor are 24 packing stations. One man watches the conveyor and moves trays off to packers when and where needed

After the printed and collated forms have been packed, they are transferred still on pallets to any one of eleven gravity roller assembly conveyors which run across the shipping room. Pallet loads are held on these conveyors until orders are complete and ready to be shipped. When an order is completely made up, it is moved directly to the outgoing shipping conveyor

The outgoing shipping conveyor brings packed forms to the shipping department, a section of which is shown here. Shippers, like the packers, are served by an "overhead stockroom," consisting of an endless chain which brings up necessary supplies and anything of a special nature that is to go with the order

Below, one of the packing stations. Metal trays loaded with forms from collating machines are taken from the pallet conveyor which runs down the middle of the room, are packed, then sent down conveyor in foreground to shipping. Note overhead chain which brings supplies to packers. When a packer needs something, she stands up and picks it off. The conveyor was purposely set so she would have to stretch — sort of like the old familiar "seventh inning" stretch at the baseball game

Above, final step in the Standard Register handling job. After orders have been weighed and routed, they are moved to this shipping bank composed of fifteen gravity roller lines, one or more for each of the carriers. At the far end of the bank another roller conveyor leads to a power belt, which leads in turn to any one of three truck stations on the loading platform

Some 6200 pressed steel skid platforms play an important handling role at McKesson's. Power trucks are used exclusively to move raw materials from freight cars to storage, from storage to production lines, from production lines to finished-goods storage—or to waiting freight cars and delivery trucks

★ BETTER HANDLING BETTERS PROFIT ★

McKesson & Robbins, Inc.

BRIDGEPORT, CONN.

LAST ON OUR LIST of selected plants where *better handling betters profit,* is McKesson & Robbins at Bridgeport, Conn. It has been chosen (1) because it is a multi-story plant and is thus enabled to make full use of gravity, that costless handler of materials; (2) because it makes some 450 products, including various sizes, some in small quantities, some in mass production, all on a straight-line basis.

Manufacturing is split into two main sections—the dry line and the wet line. At no point during the manufacturing processes on either line does laboratory control cease, as samples of finished products are taken continuously from the moving lines to the laboratory for test control purposes. Little single-purpose equipment is used. Wherever possible, equipment is standard, can be used on a variety of products. Much equipment is of the portable type; it becomes a matter of minutes, therefore, to change over a production line to handle another size or product.

Raw materials are handled from freight cars to storage or direct to production lines via skids and power trucks. For the most part, chutes move finished goods away from the lines to storage areas. Here power trucks again pick up the ball, delivering to storage or to freight cars as needed.

Calox toothpowder is a typical product of the dry line. Raw materials in bags, barrels, and glass containers are moved from freight car to elevator by power truck, from elevator by high-lift

truck to production crude storage on the third floor.

The process begins on the third floor mezzanine, a portable electric elevator being used to lift materials to the sieving apparatus and twin mixers. There are two mixers to insure continuous flow of production; while one batch is being mixed, another batch is being prepared for the other mixer.

After a batch has been mixed, it is dropped into a gyrator sifter on the third floor, then goes to another mixer on the same floor to insure uniformity. It is finally dropped to a storage tank on the second floor mezzanine. This tank is directly connected to the Calox filling machine on the second floor.

Filling, capping, cartoning, and sealing follow in non-stop order. The cartons go via special chute to the finished-goods stockroom on the floor below. Here they are piled and stored on skids, ready to be moved by power truck to waiting freight cars or trucks.

Note that production flow here, as for that matter in the making of any other of the McKesson & Robbins products, has been continuous. There has been no manual handling. Gravity has been pressed into service at every conceivable opportunity.

A Glimpse of the Wet Side

On the wet side, Milk of Magnesia is reasonably typical, and may thus be used to illustrate the handling picture.

The main ingredients are received in lined barrels and cases, which are taken by power truck and elevator to production crude storage. Materials are put in hydrating tanks and then pumped through a colloid mill, this latter being a homogenizing process.

From the colloid mill the mixture goes to adjusting tanks until the laboratory has made its analysis. When the lab okay is received, the milk is pumped into a 3000- gal. monel metal supply tank connected to the filling machine at the bottling line on the first floor on the plant.

The filling line is fully automatic with a capacity of 280 dozen bottles an hour, either 8 or 16 ounces. Larger sizes are filled on a semi-automatic line. Bottles are received in shippers, the latter going via overhead belt from the beginning of the line to the point where they are again needed.

Finished stock is piled on skids, picked up by power truck, and moved to the finished-goods warehouse on the same floor—or direct to freight car, if need be. During a recent deal, bottles were moved direct from freight car to line and back to freight car again in exactly 3 minutes.

Start of Calox line, which is quickly adjustable to the four sizes in which this popular toothpowder is packaged. Gravity has been pressed into service wherever possible in the preparation of this product and in its delivery to production line or to storage area

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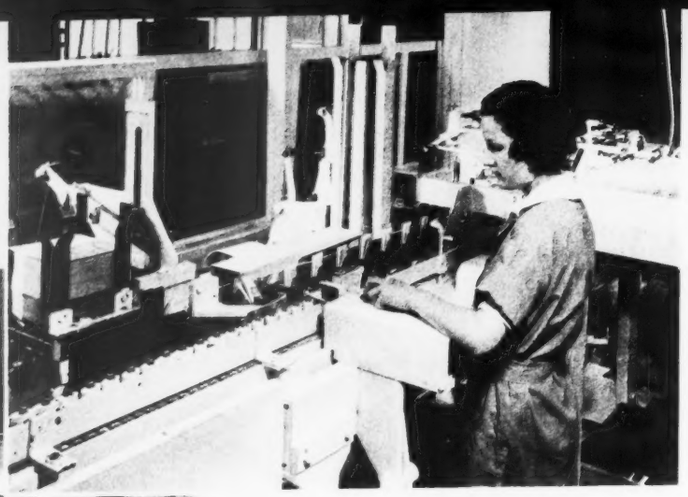
Raw materials are moved via power truck and elevator to production crude storage adjacent to production lines. Here a high-lift truck is used to pile barrels three high, thus making full use of "that space up under the roof"



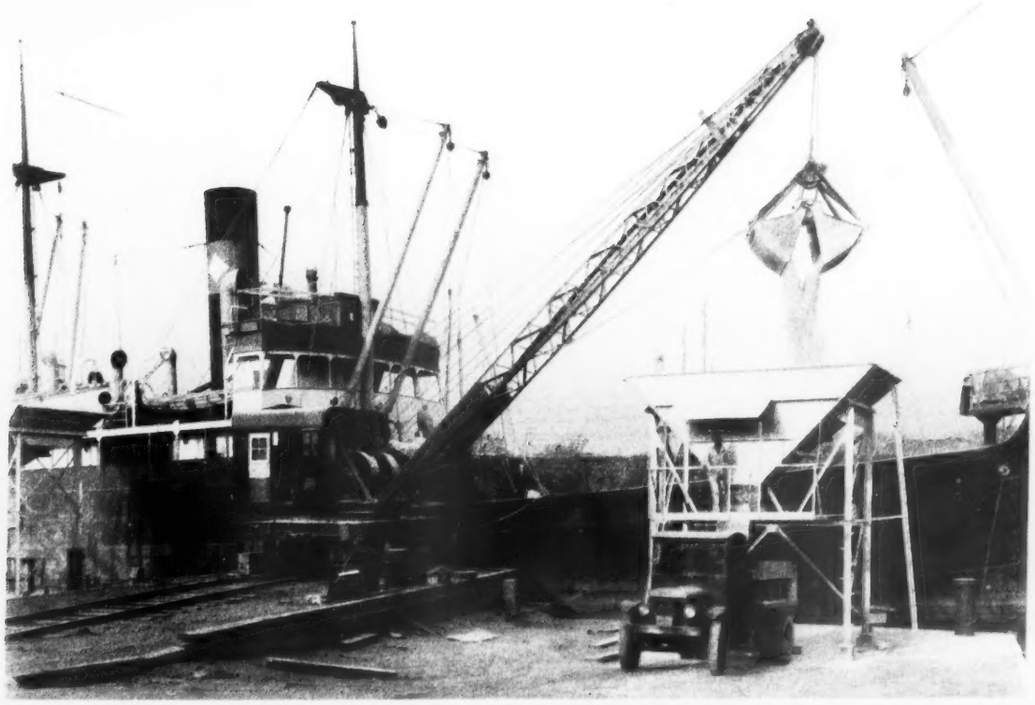
A little farther down the Calox line. Here the can has been filled and capped, is now being packaged. After being packed in cartons and properly sealed, the finished product is chuted to the stockroom on the floor below

End of the line for Calox. Cartons are piled on skids, moved to storage via power truck. Chutes are all 4-way affairs, so that four different products may be handled at the same time, and taken off at points convenient to warehouse areas where they will be stored

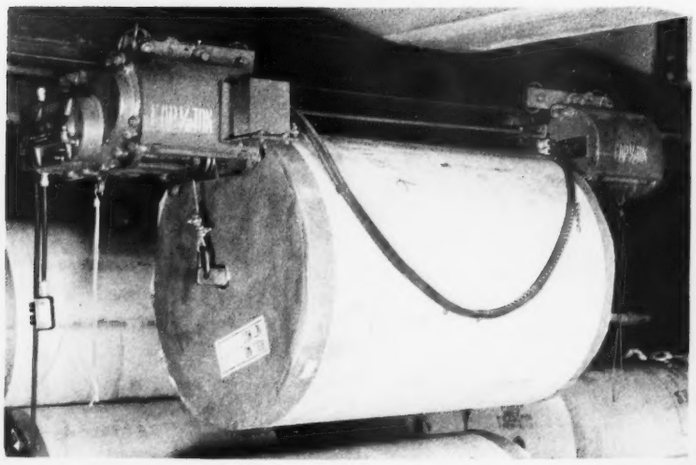
Milk of Magnesia begins. Bottles come in shippers, are delivered on skids by power trucks to the beginning of the line. Here the bottles are dumped out, ready for cleansing and filling. The shipper cartons go via overhead belt conveyor to the end of the line, where they will wait for the filled bottles

End of Milk of Magnesia line. A skid platform is ready to receive the cartons as they emerge from the sealing machine. In the background one of the ubiquitous power trucks is backing out with a loaded skid on its way to finished-goods storage in the warehouse

No Matter What the Product



To unload bulk materials from ship to hopper to truck, the 8-wheel locomotive crane with clamshell bucket provides an unusually effective method of handling which is said to save 50 per cent over manual methods that were formerly in use in this operation. Material this time is aluminum ore



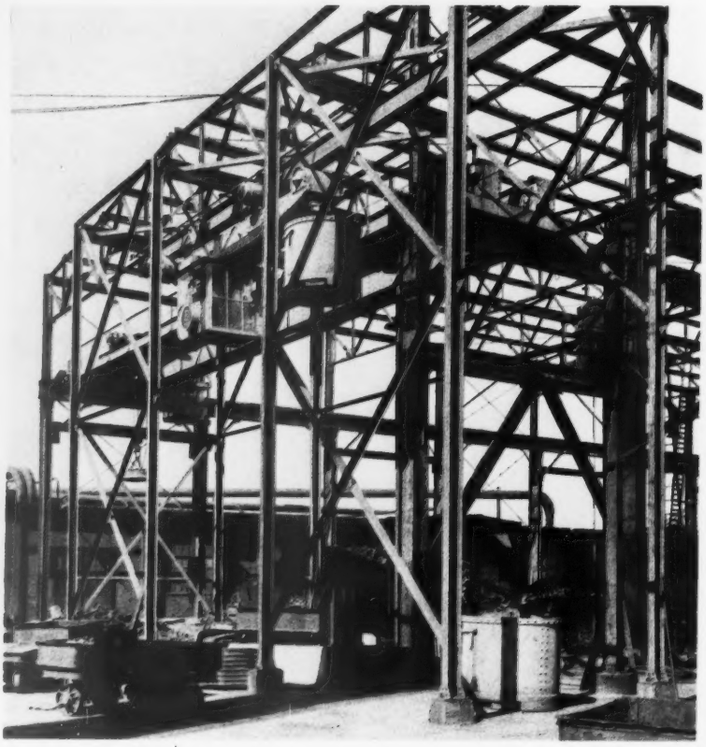
One good way to handle rolls of paper is shown on page 68. Here's still another, consisting of two ½-ton hoists arranged in tandem, with pushbutton control. Especially adapted in this case to low headroom

The sky's the theoretical limit in this fresh-air warehouse where a Los Angeles glass manufacturer defies the elements and stacks pallet loads of wine bottles and mustard jars three high. Power truck with its 147-in. lift makes short shrift of moving product to storage yard

No handling system is better than the containers in which the materials are handled. At Raybestos-Manhattan, Inc., Manheim, Pa., fiber floor trucks are used to move asbestos clutch facings and brake linings to and from, in this case, final inspection. They are light, tough, and strong

Cleaning, sanding, paint spraying, drying, and inspection — all these operations are performed in this Southern factory while maple furniture is on the move, suspended from an overhead trolley conveyor. No dents, no scratches, as the equipment handles more than 800 pieces a day

Below, at Lavine Gear Company, Milwaukee, hoists installed on trolleys are used to transport trailers from one welding job to another. Hoists are pushbutton controlled from floor



Right, cupola-charging installation at Ferro Machine & Foundry Company, Cleveland, is completely mechanized. Buckets are loaded by a 5-ton traveling crane. One charging crane moves metal charge to cupola; another handles the coke charge

MAINTENANCE SERVICES

SELECTION • INSTALLATION • INSPECTION • UPKEEP • ORGANIZATION

People and machines engaged in production must be supplied with buildings and with many services, such as electrical and mechanical power, heat, light, water, sanitary facilities, air conditioning, ventilation, dust collection, protection, communication, housekeeping. Providing these services and keeping them in condition for efficient production constitutes the Maintenance Service function. ¶ Practically every activity of maintenance service has to do with the Selection, Installation, Inspection, or Upkeep of equipment. For the benefit of FACTORY'S readers these classifications are carried at the top of the first page of each major article, and check marks are set against the classifications to which the articles belong. A fifth classification — Organization — is checked when the article deals with maintenance department organization and direction

CONTENTS

Editorials		78
They Make Machines Fit the Motors	*Arthur Van Vlissingen*	79
Six Ways to Save on Power Bills	*L. D. Cleverly*	82
Vibration Isolators Hush These Machines		84
Effective Maintenance Works WITH Production	*John I. Thompson*	86
Quicker Drying with Lamps	*E. W. Beggs*	88
Sales Set This Maintenance Budget	*John Beall*	90
They Profit by Good Lighting		92
Couldn't Run Without Instruments	*John C. Kuhns*	94
Is This the Plant of Tomorrow?	*J. F. Andrews*	96
Maintenance Service Shorts		97
Data Sheets: Motor Troubles—Symptoms, Causes, Remedies		99
What's New in Equipment		104
Trade Literature		140

Maintenance Contents of the Three Preceding Issues

JUNE

Editorials	78
Lightning in the Production Line	79
We Built for Low Cost and Comfort	81
Getting A.C. Adjustable Speed	83
Industry Saves with Vacuum Cleaning	84
Our Maintenance Foreman Is on Incentive	86
The Success of Production Is Tied to Maintenance	88
Higher Power Factor, Lower Bills	90
Synchronous Motors Do Double Duty	92
How to Select Fabric Belts	94
Maintenance Service Shorts	97
Data Sheets—Care of Idle Heating Boilers	99
What's New in Equipment	104
Trade Literature	140

MAY

Editorials	70
Which Mercury Lamp Where?	71
12-Step Inspection of Controls	74
7 Drive Problems and 7 Solutions	76
One Hydrogen Fire Was Enough	78
A Plant Is No Better Than Its Maintenance	80
For Cheap Power, Small Turbines	82
Meters Do These Jobs for Industry	84
Split Maintenance 15 Ways	86
Maintenance Service Shorts	88
Data Sheets—Horsepower Ratings for Oak-Tanned Leather Belting	91
What's New in Equipment	96
Trade Literature	142

APRIL

Quick Ways to Profits	57
A Maintenance Budget? Why Not?	61
How Six Plants Saved by Limiting Demand	64
Flexibility with Group Drives	66
Five Ways to Get More Light	69
Industrial Plant Buildings	B3
Bring Your Buildings Up to Date	B67
What Industry Must Know About Building	B110
What's New in Equipment	74
Trade Literature	100

FACTORY MANAGEMENT AND MAINTENANCE

McGRAW-HILL PUBLISHING COMPANY, INC., 330 WEST 42d STREET, NEW YORK, N. Y.

EDITORIALS

L. C. MORROW . . . *Editor*

Let's Hear How Maintenance Cuts Costs

SUPPOSE SOMEONE were foolish enough to say that the maintenance department never makes any real savings in dollars and cents, but leaves all such matters to production. Thousands of men in maintenance departments all over the country could rise up and prove by definite examples the falsity of that statement.

Granted, then, that the maintenance department can and does make savings, in operating and other costs, of which it can be proud. How much publicity is given to them? A fair answer is: Frequently none; seldom as much as they deserve.

This is an unfortunate situation for maintenance executives in general and, in particular, for those whose ingenuity and efforts produce such savings. In the one case many men in many plants have to labor and sweat over problems whose answers are well known to a few men. In the other, the man who has done a good job fails both to help fellow workers, and to receive the recognition he deserves.

The fault lies, of course, with maintenance men themselves. Some are too busy, others too modest, to talk about the results they are achieving. Whatever may be your individual reason for keeping quiet, here is a good chance to break the silence.

You have seen the announcement in the past two issues of Factory regarding the Quick Ways to Profits Issue in the fall. The rules are very simple. Anyone who can qualify stands as good a chance as the other fellow of walking off with one of the 53 awards. It costs nothing to try.

Review the work you have been doing. Pick out what you think are the best jobs of cost cutting. Put them down on paper. Send them to the editors. Do it before August 15.

The editors want to see maintenance get full credit for the fine things it does. But, first, you will have to tell the editors about them.

New Layouts May Call for Changes in Lighting

SUMMER IS USUALLY the most convenient time for shifting machines around and making needed changes in layouts. There is no doubt that all needed facilities, save one, will be considered and properly arranged for. Electric power, water, gas, air, or whatnot, obviously cannot be overlooked. Proper lighting, the exception referred to, may more easily be neglected because it is less obviously essential. A machine can run perfectly in utter darkness, but under such conditions human eyes are useless.

A lighting system that has been carefully laid out to meet a specific layout and conditions may be much less effective after machines and workplaces have been moved around. Hence the necessity for a careful check-up after any such changes to make sure that the lighting will be adequate when the dark days come again. Bear in mind, too, that in its new location a machine may interfere seriously with the lighting of nearby equipment.

And while you are about it, don't forget to look up and investigate those numerous dark spots that caused many and frequent complaints last winter.

Don't Store Equipment That Should Be Junked

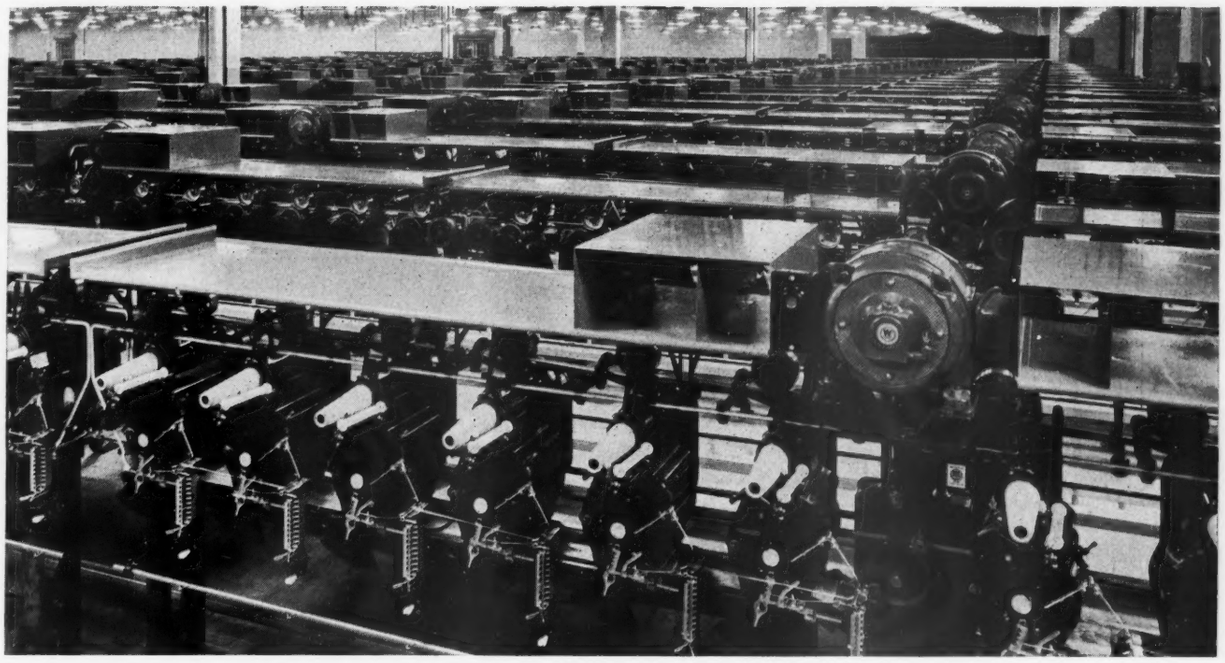
WHEN NEED SUDDENLY AROSE for another motor, the maintenance chief in one plant remembered that a spare unit of about the required rating had been standing in the storeroom for several years. It was soon located and hastily brushed off. There was no time to go over it thoroughly, but it seemed to behave all right on a short running test, and forthwith was installed.

Once in service the motor ran for about the length of time required to install it. Then there was smoke and fireworks, and the motor became a dead mass of iron and copper. Production was interrupted; men were made idle. Management was furious; maintenance was in the doghouse.

It appeared that years of idleness in a not-too-dry storeroom had permitted the coils to absorb enough moisture to cause a breakdown. An insulation resistance test would have shown this condition, and a few hours of drying out would undoubtedly have cured it.

Every plant accumulates more or less used equipment of all kinds. It seems too good to be junked; so it is put away somewhere until use can be found for it.

Before stored equipment is put back in service, some competent person should make sure that it is of proper design for the application, and is in good enough condition to make it worth installing. Better still, don't let it reach the storeroom at all unless it is in condition to give good service, or can be rehabilitated at a cost which it is good economy to incur.



Recommendations called for 1-hp. motors on the coning machines. Engineers checked the load, said ¾-hp. motors were large enough

They Make Machines Fit the Motors

That's the way Industrial Rayon goes about the problem of selecting motors for its machines. Result is that special-type motors are seldom needed, and the standard designs used lower investment, meet all requirements, operate at high efficiency

ARTHUR VAN VLISSINGEN
Consulting Editor

MOTOR SELECTION as viewed by Industrial Rayon Corporation is not to be considered as an independent electrical problem for the specialist. Rather the management looks upon it as an integral part of the whole problem of plant equipment and production. Experience here has shown that where, at first glance, every indication points to the necessity for a highly specialized type of motor, it is frequently more satisfactory to go behind the motor problem into the production machine itself, and emerge with a simplified set-up that leads to using a motor of standard design.

First consideration of motor selection in every plant is, of course, the special conditions encountered there. In some departments at Industrial Rayon, motors must operate in an atmosphere which at times contains some hydrogen sulphide, of which a very small amount is sufficient to tarnish copper. Therefore, d.c. and slipring motors were eliminated from consideration. Straight induction motors are essential, except for a few applications where synchronous motors of large size fit into the picture. And induction motors carelessly applied may lead to too-low power factor.

As L. J. Jordan, chief engineer of Industrial Rayon Corporation, explains it, the company's policy is to consider with utmost care the exact type and size of motor required for a job. This study necessarily includes considering the type of machinery driven; whether it imposes a high starting load and subsequently low running load at high speed; whether any features that might require a special type of motor may be changed, corrected, or eliminated before going ahead with the motor specification. Under this policy, motor selection does not start with accepting the machine as it stands; the problem is approached by figuring out whether the machine can be made to fit a more economical and efficient kind of motor.

For example, in equipping the new plant at Painesville the company engineers came to the coning machines.

"We could have specified motors conforming to the recommendations of the machine manufacturer," admits Jordan. "It would have saved us a lot of time and effort. Instead, we made an individ-

ual study of the machine and its power requirements. Net result was that we came out with a motor entirely different from the recommendations. And because of the study to which the problem was subjected, we chose a standard motor."

The recommendation called for a 1-hp. motor. Industrial Rayon got one of the coning machines, put a wattmeter in the motor circuit and charted the load from starting all the way through the cycle as the machine warmed up, and as load was added or taken off. A careful effort was made to anticipate any probable changes in production requirements—this is standard procedure when making such a study.

When the chart was analyzed it was found that starting torque requirements were normal. At times the load reached a value of 0.82 horsepower, but only for very brief periods. Therefore a ¾-hp. motor was ideally suited to the job. After discussing the results of these load tests with the vendor of motors for the plant and obtaining his approval, the order was given for ¾-hp. motors of conventional type. And these motors have been serving very well.

Each motor selection problem is subjected to the dual test of previous experience and calculation. The plant engineers not only put a wattmeter on a machine which is undergoing tests, but also they often drive it through a variable-speed transmission and change the machine speed by minute increments until they find the optimum. It is frequently found that instead of speeding up the machine, the most profitable operation will be at lower speeds.. When the answer is finally arrived at, it becomes a simple matter to select the motor that will give the necessary speed, operate at the highest power factor, and so forth.

Where it is anticipated that future requirements of production will require a change of machine speed either upward or downward, a variable-speed transmission or a train of gears is frequently built right into the installation, so that when the eventual change of speed is decided upon it can be brought about without any interruption to production.

What might be termed the underlying philosophy of the Industrial Rayon motor selection policy comes from thinking of motor capacity as a fixed or inflexible factor, once the motor is installed. Machine capacity, on the other hand, is thought of as flexible. Since the motor cannot be changed or scrapped without a capital loss and probably an interruption of production, it is advisable to get down to bedrock facts in selecting the motor in the first place. Thus there will be a minimum of changing and other troubles in the future.

In making a pre-purchase study, the engineers probably find an optimum load which prevails most of the time. If they ascertain that overloads are probable only infrequently, and then only for short periods, what of it? It is better sense, they feel, to run a motor briefly on a reasonable overload rather than to overmotor the job, pull down the power factor, and end up by having to put in more copper all through the system.

Revised for Greater Output

When a machine is overmotored their policy is not to do the obvious and superficial job of changing the motor. Rather, they incline to see whether the machine's cycle cannot be speeded up to get more output and keep the motor working at rated capacity. At the Covington plant, for example, they had a machine that was rated at 7½ horsepower. The load it was pulling actually required 13 horsepower. What they did here was to revise the machine for greater production. They ran up its load to 17 horsepower, put on another motor driving in parallel on the same shaft, got it all nicely balanced—and cut production costs at the same time.

In planning one plant they came upon a machine which was rated at 5 horsepower and was found to impose this load. But before going ahead with the selection of 5-hp. motors for the job, they put in one of the machines experimentally and began tinkering with it. By altering the lubrication they reduced the load to 2 horsepower, thus making a substantial saving in the original investment in motors for the battery of machines at the new plant, besides greatly reducing the power requirements as well as wear on the machine itself.

On many applications the company uses motors considerably smaller than standard, because of the policy of fitting the motor to the job or fitting the job to the motor. Another way of saying it is that in any operation there is likely to be a bottleneck somewhere along the line, whether in motor or production machine.

Soaking presses at Industrial Rayon

LEAVES FROM INDUSTRIAL RAYON'S MOTOR BOOK

. . . motor selection is not an independent electrical problem, but an integral part of the whole problem of plant equipment and production. . .

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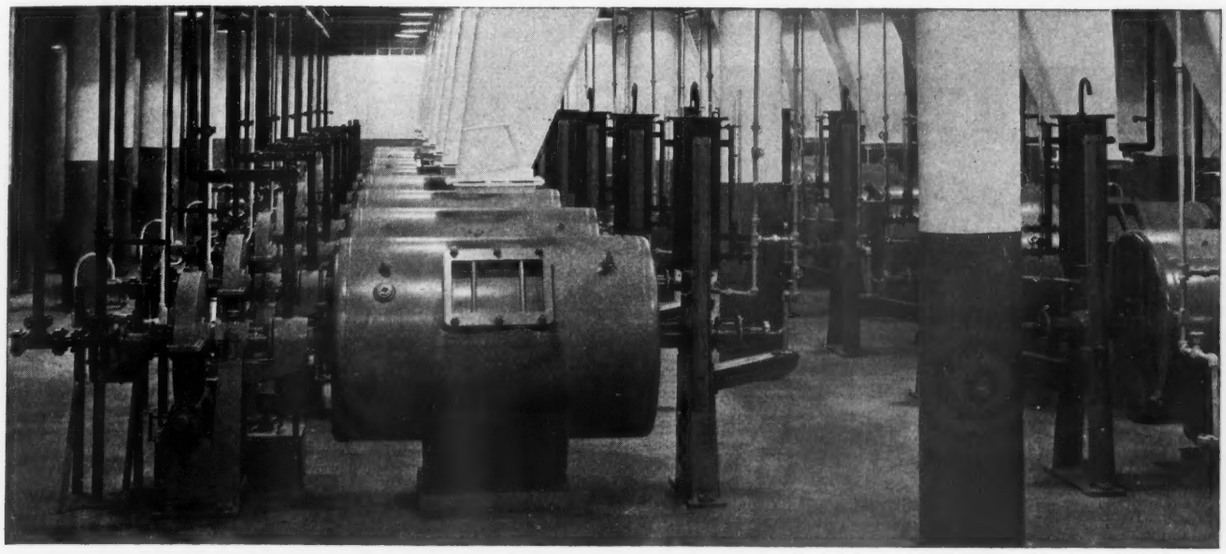


If power fails, these xanthators must be turned by hand. A free-wheeling clutch permits them to be turned by a crank

differ in design from those commonly used in the industry in that they are not hydraulically operated but depend upon a large screw to furnish pressure. The screw turns at very low speed. At first the presses were driven by a two-speed, double-wound motor, so that the head of the press would go up very slowly on the working part of the cycle and come back very rapidly to receive another charge.

Through development of the soaking press it was found possible to run the head both up and down rapidly, thus doing away with the necessity for the special-type motor. Successful operation depends upon having very accurate limit switches to stop the motor at a predetermined moment and reverse it.

An interesting, special application of auxiliary drive equipment to motors is found on the tumbling barrels or xanthators at the Painesville plant. Here totally inclosed motors are used. These machines absolutely must not be stopped. In the event of power interruption they must be turned by hand. Therefore, a free-wheeling clutch has been installed between the motor and the machine.

A somewhat similar installation, for another purpose, is found in the Painesville power house. Here a motor with an extended shaft is hooked up with a turbine on one side and boiler auxiliaries on the other. If it becomes desirable to run the turbine for heat balance or because of electrical failure, it is driven right through the motor. Again, a free-wheeling clutch has been installed between the turbine and the motor.

When it came to motoring the spinning machine at Painesville, the engineers had a small section of this machine built for chemical and mechanical research and development. The first machine thus tried was overmotored. But a careful study showed that, by changing the type of bearing and lubrication, the horsepower requirement could be greatly reduced. Hence another experimental machine was built. Again the engineers were not satisfied, although it imposed a smaller load. Therefore by a change in lubrication they reduced the load from 10.5 to 8.2 horsepower. They knew, however, that the machine would eventually be speeded up; therefore, they put on a 10-hp. motor. And because it could be used most efficiently by building it into the machine, they had the vendor supply only the rotor, stator, and one endbell.

Using General-Purpose Motors

On the spinning and process section, this big machine requires only normal starting torque; therefore the two motors were selected accordingly. On the twisting section two general-purpose motors are used. On the auxiliary equipment for each machine are a motor to pump hot water for drying reels, and a motor for pumping an emulsion solution. These two auxiliary motors are of standard design. The emulsion pump, however, has the special requirement of pumping a solution that must not be contaminated. Accordingly the pump manufacturer was asked to make a hard rubber pump that will run on its side. The motor vendor supplied a vertical motor. This motor has a special shaft extension which can be covered with an aluminum sleeve, leaving no steel exposed at any place. This sleeve connects the pump to the motor. The pump is supported by the motor through another and larger sleeve.

Incidentally, the sleeve for the stuffing box is made of graphite, which is immune to the chemicals used in the process. Industrial Rayon engineers have found that graphite is an excellent material for use in many places where corrosion resistance is necessary.

The problem of selecting motors for shredders in the Painesville plant was solved by working out the proper methods of operating the machine. The experimenters started out by running the machine as fast as the makers recommended, which was twice the normal speed of operation for this type of machine. They finished up by running at normal speed, with normal horsepower requirements, but producing twice the output. In arriving at the final decision a variable-speed transmission was, of course, used as previously outlined.

This article has made no effort to cover the individual selection of each of nearly 900 motors in the new plant of Industrial Rayon Corporation at Painesville. Obviously, such an itemization would require a book. The methods described in this article, however, have been employed to get the right motor on each job all the way through the plant. How successfully they have worked may be judged by the fact that, with only a few synchronous motors, and the bulk of the plant's motoring done with squirrel-cage induction types, the power factor runs very close to 90 per cent.

Six Ways to Save on Power Bills

TO REDUCE POWER BILLS

1. **Study power contract for opportunities to make savings**
2. **Consult utility's engineers to make sure contract is the best and cheapest for the kind of service required**
3. **See to it that all electric motors are properly loaded**
4. **Consider advisability of correcting low power factor**
5. **Check possibility of reducing electrical demand peaks**
6. **Shut down motors, and turn off lights, when not needed**

L. D. CLEVERLY

Maintenance Superintendent, Harris-Seybold-Potter Company, Cleveland

THOROUGH KNOWLEDGE of the terms and provisions of any contract is essential to the proper conduct of business. With electric power contracts, in particular, it is necessary to know how they operate before full advantage can be taken of the opportunities for reducing the size of power bills.

Accepted forms of electric rates may be divided into two main classes, and each of these into several types of rates as follows:

Meter Rates	*Demand Rates*
Straight line meter	Flat rate
Step meter	Wright demand
Block meter	Hopkinson demand
	Three-part demand

Meter rates apply only to very small industrials and savings may be effected only by analyzing metering procedure.

With the Straight Line Rate the price charged per unit does not vary, regardless of the increase or decrease in the use of power.

The Step Meter Rate, a form now obsolete in some states, sets a certain price per unit for the entire consumption, the rate depending upon the particular step within which the consumption falls. The rate decreases as consumption increases.

In the Block Meter Rate a certain price is charged for all or any part of a block of such unit, while reduced prices per unit are charged for all or any part of succeeding blocks of such units.

To large users of power the term Demand Rate applies to any method of charging for electrical service which is based upon, or is a function of, the size of the installation, or the maximum demand, expressed in kilowatts, kilowatt-amperes, or horsepower.

The term Flat Demand Rate refers to a charge for electric service. It is usually so much per kilowatt or per horsepower per month or year. The Modified Block Rate is usually so much per customer per year or month, but estimated demand and quantity of energy play an important part.

The Wright Demand is a method of rate charges first proposed by Arthur Wright, which was the first to recognize load factor conditions. It included a high rate per kilowatt-hour for a certain number of hours' use, all excess hours being at a lower rate.

A sizable plant in southern Ohio had the light and power on separate demand meters, so that two demand charges were being paid. I called attention to the fact that if the lighting current were transformed from the power source and the demand run through one meter, the plant would be entitled to a larger discount on the demand. The power company agreed to make the change. An investment of $150, which included the purchase of a lighting transformer and the necessary wiring, resulted in a saving of $30 to $35 per month. This is the only type of saving that can be made under Meter Rates.

Hopkinson Demand Rate

In 1892 Dr. John Hopkinson devised a method of charge called the Hopkinson Demand Rate which consists of a demand charge, a sum based upon the estimated or measured demand, or the connected load, plus an energy charge, a sum based upon the quantity of energy used.

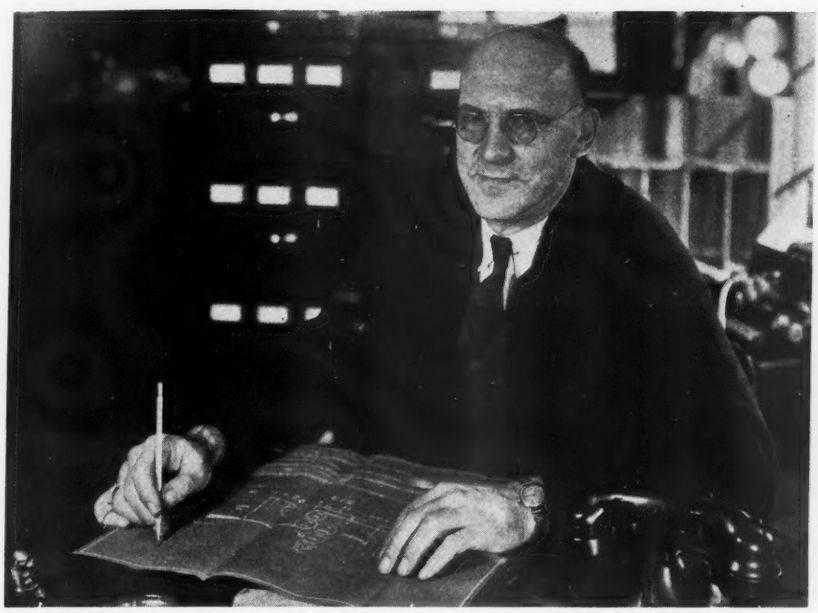
This method of charging was modified by another method called the Block Hopkinson Demand Rate, in which either the demand charge or the energy charge or both may be of block form. The last two methods are the most commonly used.

Power users actually pay for two kinds of current. The first is power-producing current, which is converted by electrical equipment into useful work and registered on the meter as kilowatt-hours. The second is magnetizing current, which cannot be converted into useful work although it is needed for the operation of motors and other kinds of equipment.

Power factor is simply the proportion of the power-producing current to the total of the two currents.

Clauses in many contracts provide that the power factor shall be maintained as near 100 per cent as possible, or state that if it falls below 75 or 85 per cent, a penalty is applied. Above these figures a premium is given, so that many consumers have used synchronous motors running either unloaded or slightly loaded to correct the power factor. Synchronous motors used as condensers are, however, gradually being replaced by static condensers which have negligible power losses and no maintenance cost.

An industrial plant in this district had a 250-kva. synchronous motor-generator set direct-connected to a 100-kw. d.c. generator. While some of the d.c. energy was used, this machine was allowed to float on the line 24 hours a day to correct power factor. Power losses of the synchronous set were found to be 24 kilowatts, amounting to 180,000 kilowatt-hours in



L. D. Cleverly attended Clarkson Institute of Technology. He spent many years in various steel and cement mills as construction superintendent and chief engineer, and served for three years as chief engineer of The Standard Oil Company (Ohio) in charge of all wholesale and retail dispensing activities

the course of a year. Capitalizing this loss at 1½ cents per kilowatt-hour together with the cost of operation plus carrying charges gave a total of $3,300 annually. Shutting down this set and purchasing condensers totaling 210 kilovolt-amperes for $1,695, left a balance of $1,605 in money after a year's operation.

To illustrate how power factor enters the picture let us take this power schedule:

Demand Charge, $2 per kilowatt for the first 50 kilowatts of demand, $1 per kilowatt for all in excess.

Energy Charge, 1.3 cents per kilowatt-hour for the first 40,000 kilowatt-hours, 0.9 cents per kilowatt-hour for the next 60,000 kilowatt-hours, 0.67 cents per kilowatt-hour for all in excess of 60,000 kilowatt-hours.

When the demand falls below 20 kilowatts the commercial service rate applies. If the average power factor is above 75 per cent the billing demand is the measured demand multiplied by 75 and the product divided by the average power factor in per cent. If the average power factor is less than 60 per cent the billing demand is similarly adjusted to 60 per cent.

Assuming that the demand was 470 kilowatts, the amount of energy used was 81,600 kilowatt-hours, and the reading of the reactive kilovolt-ampere-hour meter was 28,800, the bill would be as follows:

Demand Charge		
First 50 kilowatts at $2=		$100.00
Next 420 kilowatts at $1=		420.00
		$520.00
Energy Charge		
First 40,000 kilowatt-hours at 1.3 cents=	$520.00	
Next 41,600 kilowatt-hours at 0.9 cents=	374.40	
		894.40
Total Bill		$1,414.40

This would be the bill without power factor adjustment, but dividing 28,800 reactive kilovolt-ampere-hours by 81,600 kilowatt-hours, gives decimal 0.3517, equal to 94.3 per cent power factor on the chart. The contract states that 470 kilowatts demand times 75 divided by the power factor, 94.3 per cent, will give the adjusted demand, in this case 373.8 kilowatts. Then 470 minus 373.8 equals a saving of 96.2 kilowatts or $96.20 off the bill.

Rates May Be Modified

Had the power factor been 54 per cent instead of 94.3 per cent the adjusted demand would be 470 kilowatts times 60 divided by 54 per cent, or 522 kilowatts. Then 522 minus 470 equals $52 which is added to the bill as a penalty.

Any of the foregoing rates may be modified by the addition of a customer charge and the rate becomes a Three Part Rate, but the customer charge is actually so small that it means practically nothing.

Many power contracts contain the terms Primary and Secondary with reference to metering. In most such contracts the type of metering is optional with the customer. These terms also may be made to disclose hidden dollars of savings.

Primary metering means that the incoming power is metered on the high-tension side of the transformer. Contracts usually allow a deduction from either the demand charge or the energy charge or both to compensate for the customer's payment of transformer losses.

Secondary metering means that the incoming power is metered on the low-tension side of the transformer and the consumer pays the regular price. The utility absorbs the transformer's losses.

It is important to keep transformers loaded as near to capacity as possible in order to keep losses low.

Study of a power contract will almost certainly disclose the most fruitful sources of savings. Consultation with the utility company's engineers, particularly if there have been marked changes in the load, is always advisable. They will gladly advise any customer as to the cheapest and best type of contract for the service required.

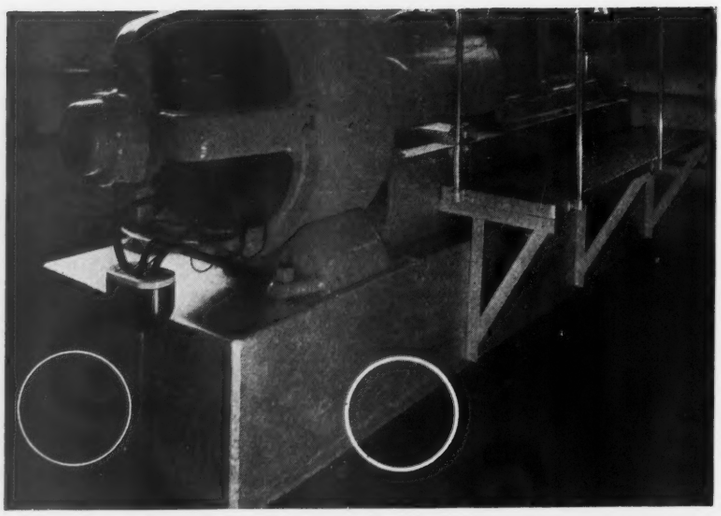
One of the first steps in any attempt to reduce power bills is to check each motor to make sure that it is loaded properly, and is of the proper type for the application. Motors that are loaded close to rating operate at higher efficiency and power factor.

Motor-generator sets for providing direct current frequently use an induction motor that is lightly loaded most of the time. If this motor is large enough to affect the plant power factor seriously, it will be advisable to replace it with a synchronous motor, or use the new, large-capacity rectifying tubes to supply direct current.

Demand peaks can be reduced, thus lowering demand charges, either by staggering the operation of large power-using apparatus or arranging to have ovens or other equipment taken off the line, automatically or manually, when the load reaches a certain point.

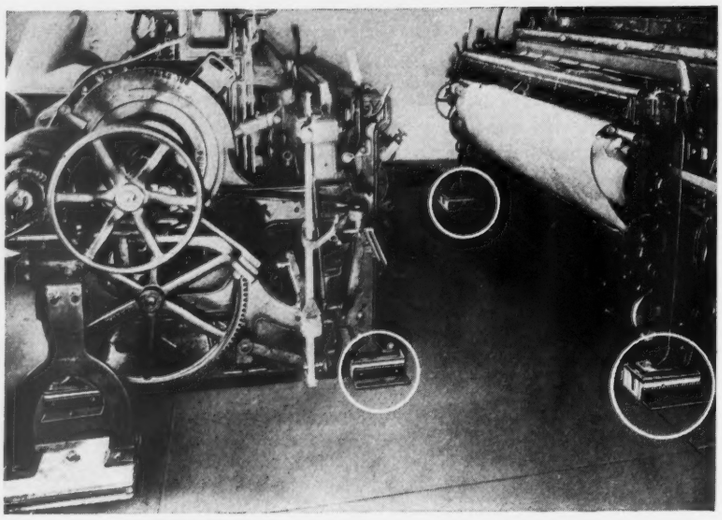
Unnecessary operation of machines and burning of lights when not needed must, of course, be avoided. Losses from these sources may amount to a considerable sum.

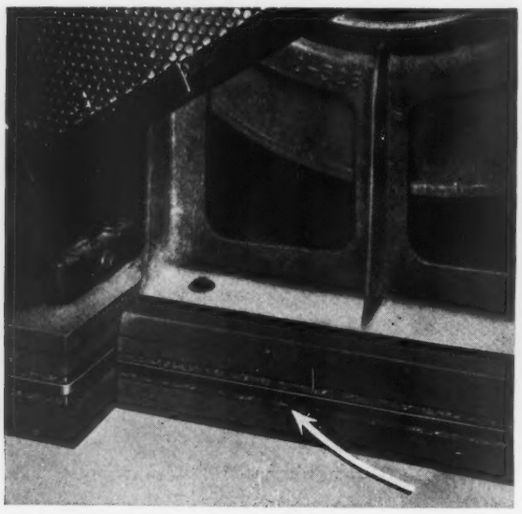
Vibration Isolators Hush These Machines



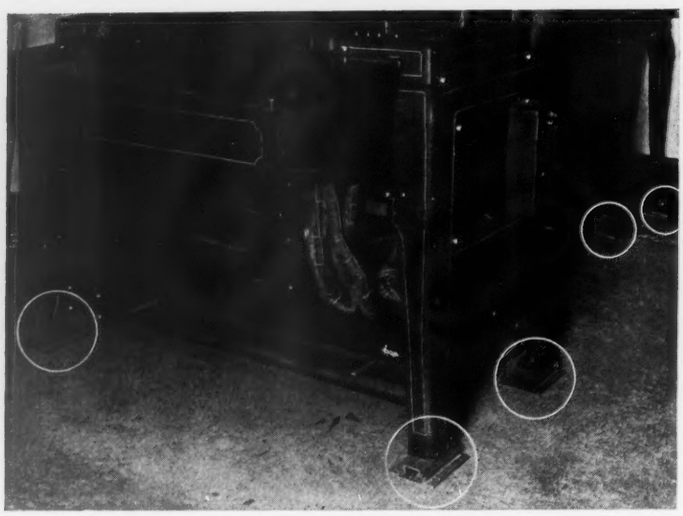
Synthetic material (Keldur) under foundation damps vibration of diesel engine

Special cork isolators (Korfund) absorb three-way movements of a woolen loom

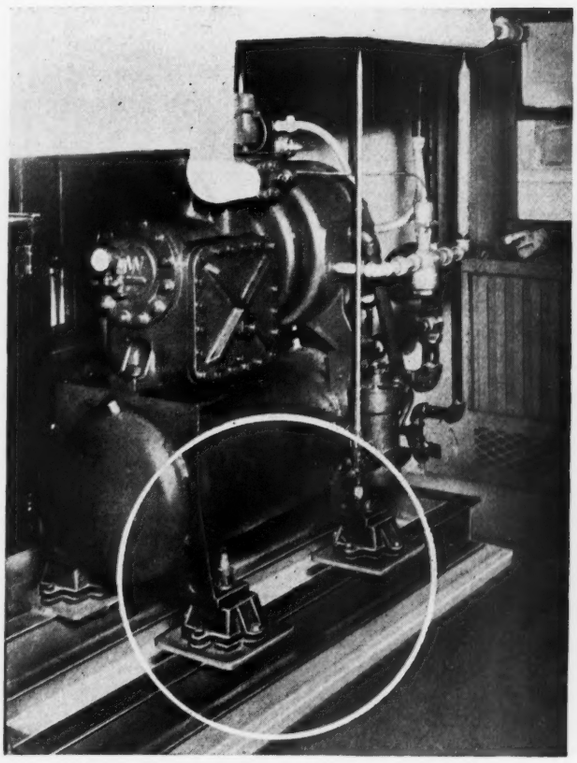




Steel-bound natural cork mats (Mundet) are used under the motor and fan of an air conditioning installation

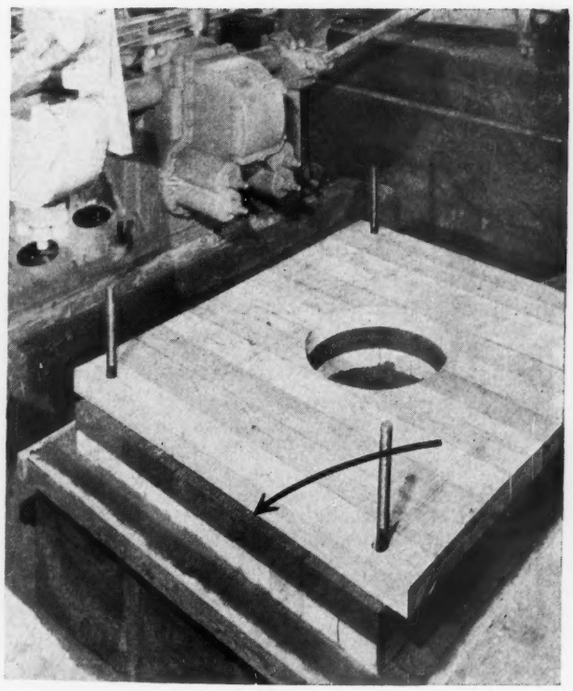


Any vibration when this printing machine is operating does not get beyond the steel-and-rubber dampeners (Goodyear) on which it is mounted

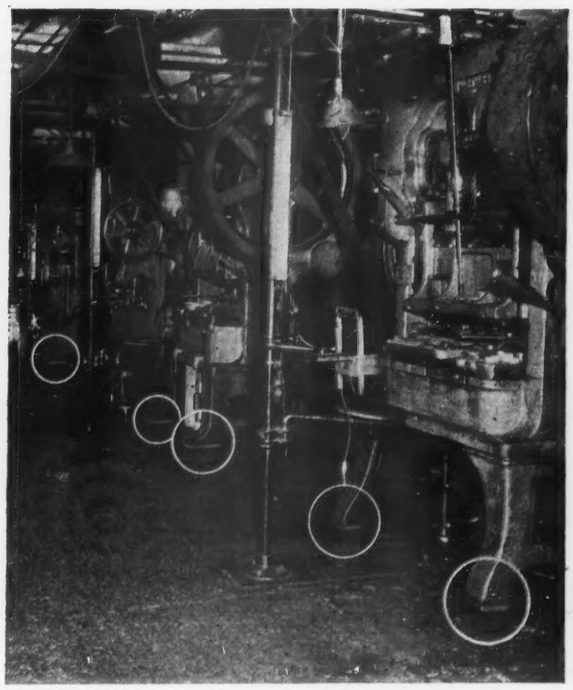


No one is disturbed by the operation of this air compressor, because vibration is absorbed by spring (Korfund) dampers

Rubber-and-steel insulators (Goodrich) protect a centerless grinder from the vibration produced by nearby punchpresses



Heavy cork boards (Armstrong) in a mold-jarring machine's foundation will make this foundry a better place to work in



Under the feet of each press is a heavy felt pad (Felters) which prevents its vibration from reaching the floor

EFFECTIVE Maintenance

JOHN I. THOMPSON

Director, Engineering and Maintenance, Sharp & Dohme, Philadelphia

WE IN INDUSTRY are prone to think of our maintenance departments as purely spending functions. Frequently we do not *think* of them at all. However, they are as important as the technical departments which develop our products. Maintenance is as much a part of manufacturing as is production.

An unbalanced, untenable position results when a firm finds that its maintenance has fallen far behind because it has concentrated on production.

The maintenance department is the trail-breaker. It provides the production services. It contributes to the finding of a practicable use for the production tools. It keeps the productive tools operating. It works with production to find the easier way. It is the housewife who brings out the slippers and sets the table appetizingly.

Maintenance should be just as cooperative as production's own stores system. The delivery of power to a machine is as important a service, and as complete a manufacturing function, as the delivery to the same machine of the material to be processed.

The master mechanic and the production foreman are serving the same purpose. To accomplish this purpose it is necessary that they have the same viewpoint. When one of them must be brought around to this viewpoint, more often it is the "M.M." He is apt to "ingrow" and limit his thinking to shop and maintenance tools, and even production's injustices. His shop and his tools are important, but the number one job of all manufacturing is producing the maximum number of production units per person employed in any given period. To a plant engineer, "packages per employee, per month" cannot be lost sight of when thinking of "gallons of fuel oil consumed."

To achieve the ends desired by management, maintenance should put itself on a production schedule. In any plant, it has certain capacities—in manpower, in kilowatts, in maintenance equipment. These should be carefully analyzed, then fitted into the production picture. Just as the production department levels out peaks and valleys by scheduling, to enable constant employment, so can the maintenance department.

This calls for a very close, regular, "field inspection" of the plant, and all its equipment. Nothing is too small to require a regular inspection. Unfortunately, we are all so far from infallible that we cannot know at once all that should be covered, but experience will bring out failures, and these should be studied and covered by inspection to prevent repetition.

Where production has a quality control division to check it, maintenance does not, and has to depend on itself, with the accompanying tendency to become lax. In some larger plants it has an engineering department which performs a semblance of this duty, but mostly it is its own inspector. This inspection is the most important single thing in effective maintenance.

Schedule Work Weekly

Then, with the maintenance department knowing its capacity and the demand shown by inspection, it can work out an intelligent weekly schedule for work. This must have keyed into it two other factors—the materials and supplies needed for the work, and the period when it can be done without production interference.

To build up an effective maintenance personnel is a long and arduous task. Of course, an ideal group would be one in which any member would be competent to do anything. In a smaller organization it is well to aim toward this, mindful of the "peaks and valleys."

Even in a larger organization, this is a good aim, particularly when the plant is located in a community of large population. Then the maintenance organization can be formed to take care of the most acute emergency. Much of the routine work can be contracted for, with reputable firms. I have in mind painting, partitioning, tinsmithing, "out-of-face" work of any nature. This arrangement makes it easier to cut costs when sales are falling off.

In following a system after it is once established, the maintenance department can fit itself into a budget, production-wise. There recently came to my attention a method of maintenance budgeting that was quite sound. A basic minimum was established and called "General Maintenance." Monthly, the plant engineer estimated "100 per cent maintenance," and then was allowed an amount varying between the basic minimum and the 100 per cent. The actual amount was determined in relation to the sales outlook. Such a determination could not be arrived at practically without a system.

A maintenance department may have additional functions besides those which are directly contributory to product manufacturing. For instance, in many plants it generates electric power. A true and complete cost of such power should be compared regularly with estimated costs for power from other sources. In such instances, the maintenance department really is functioning just as a supplier of any raw material does. This same condition applies in supplying process steam, general "landlord" service, and other items. When performing these services the maintenance department must be concerned primarily with keeping the operating division a happy, satisfied customer. Really, this grouping is a Service Department.

To sum up, a maintenance department has as its purposes:

Primary: Maintaining production, involving

a. Work scheduling.
b. Facility improvement.
c. Budgeting and cost control.

Secondary: Supplying services, involving

a. Operation of service equipment, such as prime movers.
b. Maintaining a low-cost distribution of service.
c. Anticipating service demands.

Management should control the activities of maintenance by asking, "Do

Works WITH Production

John I. Thompson has turned out real well despite the fact that he was infant prodigy enough to enter college at the exceedingly tender age of 14. He went to Penn State, as who wouldn't if his grandfather had helped to found it.

Now only 32, he's seen service with Stone & Webster, Central R.R. of N. J., Bristol-Myers. Once in a while he gets away from maintenance, always seems to gravitate back into it.

Strangely enough for a mechanical engineer, he's helpless with his hands—says he always found it easier to get someone else to do the work for him

we have the supplies *and* maintenance to produce?" and "What *does* our service cost?" In the first instance it must look at maintenance as a part going into its finished product; in the second, as purchaser of a service or supply.

No general rule can be laid down to accomplish this. Organizations depend upon personalities, so organization charts made for one set of conditions usually do not hold for another. The most satisfactory comparisons are studies of end results. In comparative lines the operating ratio is a good yardstick. Maintenance allowances should be determined from that. Conditions can exist where maintenance taken alone is more costly in a comparison, and yet product unit cost is lower than if the reverse were true. This condition exists in the more highly mechanized establishments, and in them the function of "maintaining production" rather than "repair" reveals itself more clearly, although it is true in *any* establishment.

Quicker Drying with Lamps

These lamps give off little light but lots of heat rays, and furnish industry a simple, safe, and efficient means of performing a variety of heating and drying operations

E. W. BEGGS
Assistant Manager
Commercial Engineering Department, Westinghouse Lamp Division
Westinghouse Electric & Manufacturing Company
Bloomfield, N. J.

RADIANT ENERGY from electric lamps known as "drying" lamps is doing many industrial heating, drying, and baking jobs better, quicker, and cheaper than any other source of heat. For example, in the Ford plant more than 10,000 infra-red drying lamps are used to dry enamel on automobile bodies. With this form of heat a dry, hard surface is obtained in one-sixth the time formerly required. Similarly, a rug-cleaning concern has cut the drying time down to a small fraction of that required in a hot-air oven.

These lamps are now being used to dry paper, inks, latex, textile fabrics, fiber products, photographic film and prints, leather goods, plastics, and even for miscellaneous jobs such as heating automobile engine piston heads to expand them prior to the insertion of the wrist pin.

The chief advantage of radiant energy or heat is its power of penetration. It can be directed, and its action is largely independent of air circulation. Lamps as a source of infra-red energy are efficient and safe.

Actually, radiant heating is as old as sunshine itself, or the heat from an open fire. Radiant electric heaters have been available for many years and have been used widely. Long-lived, low-priced, tungsten-filament lamps are now available, and since electric power is cheaper than ever, electric lamps are among the most practical sources of heat.

Basic facts involved in the use of radiation from drying lamps are relatively simple and well known. Details of the technique of application, however, must be developed for each use; therefore the fundamentals should be clearly understood before the technique is studied.

A heated object conveys its heat energy to other objects it touches, by the process known as conduction. Such an object also conveys heat to the air around it. This process is known as convection. With objects heated only to low temperatures, radiation is of relatively small value; when the temperature rises to high values, radiation becomes increasingly important. In a lamp filament, from 70 to 85 per cent of the energy given off is radiant. Conduction and convection account for only a small part of the energy.

Infra-red rays are invisible radiant energy located in the spectrum just beyond visible red light. Approximately 50 per cent of the energy in the sun's rays that reach the earth is infra-red radiation. Similarly, the warmth felt in the rays of a flame, from a red-hot poker, or from a lamp filament or electric heater is for the most part radiated infra-red energy.

These sources radiate energy, and some of it is visible to the eye. That part of the energy that is visible is known as light. Some of the energy is of shorter wave length than the eye can see, and is known as infra-red. Of the radiations from an ordinary electric lamp, for example, approximately 90 per cent are infra-red, somewhat less than 10 per cent is visible light, and about 0.1 per cent is ultra-violet. With "drying" lamps, infra-red represents more than 95 per cent of the energy radiated, visible light represents less than 5 per cent, and ultra-violet a negligible amount.

Infra-Red Acts Like Light

A 250-watt, 115-volt, tungsten-filament "drying" lamp is identical in appearance with a clear 200-watt Mazda lamp. It has a 10,000-hour life and gives about the same amount of visible light as a 100-watt lamp, but it is much redder in color.

Infra-red radiations act like light. In dealing with them, practically all the laws that apply to visible light also apply.

Radiant energy travels in straight lines. This means that shadows are created with invisible infra-red, just as with light.

As with light, infra-red energy is reflected by some surfaces and absorbed by others. A dark-colored surface absorbs more than a light surface, and a rough surface more than a smooth or polished surface. In general, all substances and surfaces that are highly effective reflectors of light are effective reflectors of infra-red rays. Similarly, substances that absorb light usually absorb infra-red.

When infra-red radiations strike a polished surface they are reflected like light: the angle of incidence and the angle of reflection are equal. Similarly, they are diffused by a mat reflector such as rough aluminum or porcelain enamel. They are also bent as they pass through lenses or prisms.

The heat felt from an infra-red radiator is the result of absorption of the energy. A perfect reflector does not become heated when infra-red strikes it. Heat is developed only when the energy is absorbed.

There is a heating effect, of course, when any radiant energy is absorbed, whether it be infra-red, visible light, or ultra-violet, and the heating effect is the same if the same amount of energy is present. For example, when completely absorbed 1,000 watts of radiant ultra-violet energy causes exactly the same rate of rise of temperature as 1,000 watts of visible energy, or 1,000 watts of infra-red energy.

For this reason the existence of a small amount of visible light in the radiant energy from a lamp does not signify that it is less efficient for the production of heat than a device radiating invisible rays only. The advantage of having the small amount of visible light present to show how the radiator is performing is, therefore, obtained without necessarily reducing the heating efficiency.

Infra-red energy penetrates. This fact is perhaps most plainly shown in the drying of a rug. It is difficult to dry a

wet rug because of its nap. Water is held deep in the meshes of the fabric where the heated air of an oven cannot readily reach it. Drying lamps mounted in suitable reflectors project their energy deep down into the rug, causing rapid heating and quick evaporation.

Radiant energy may be directed downward, or to a distance of many feet. Heating by radiant energy is largely independent of atmospheric conditions. No movement of the air is needed, which reduces the dust hazard. Radiant heat will penetrate a glass inclosure—even a vacuum.

In addition to these advantages there appears to be a chemical effect of radiant energy that may have a far-reaching influence. Just as roasted food does not taste like baked food, so radiant heat produces somewhat different chemical effects than the heat of a baking oven. This fact may be more important than all the others, and because of it entirely new and better processes may result from the use of the drying lamp.

Drying lamps are gas-filled to minimize losses caused by bulb blackening and are the most efficient practical sources of radiant energy. They are cheap to install, since standard lighting sockets, wiring, and in many cases standard reflectors, are used.

The wattage, lamp-to-surface distance, position of the object and lamp, and the time required, must be established in detail for each application.

MAINTENANCE SERVICES

TO USE DRYING LAMPS

1. **Mount the lamps in efficient reflectors producing a fairly smooth beam of radiant energy of from 20 to 40 degrees divergence.**

2. **Locate the reflectors and lamps so that the beams of radiant energy cover the surfaces to be heated approximately uniformly. This factor can be roughly judged by the character of the visible illumination.**

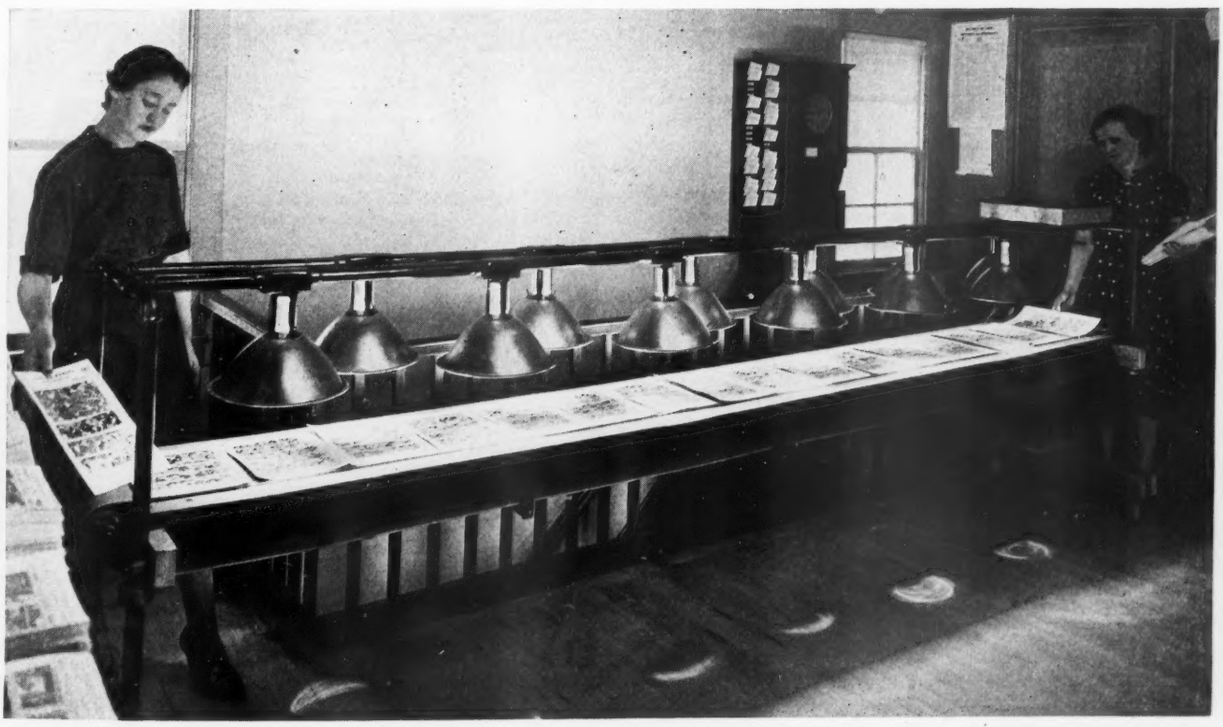
3. **If the objects being heated are on a moving belt, lack of local uniformity is less serious than when they are stationary. For this reason drying on a moving belt is usually preferable.**

4. **Radiant energy must be directed to all of the surfaces to be heated. Areas that are in "shadow" are relatively cool. By suitable aiming of reflectors, this difficulty can be eliminated.**

5. **The color of the surface greatly influences the heating effect. In general, a dark-colored object heats up and treats out much faster than a light one.**

6. **A rough surface heats faster than a smooth surface. This factor is commonly somewhat less important than the color.**

7. **Provide means for varying the treatment if different products are involved, by switching, such as turning off alternate lamps, or varying the speed of belt travel.**

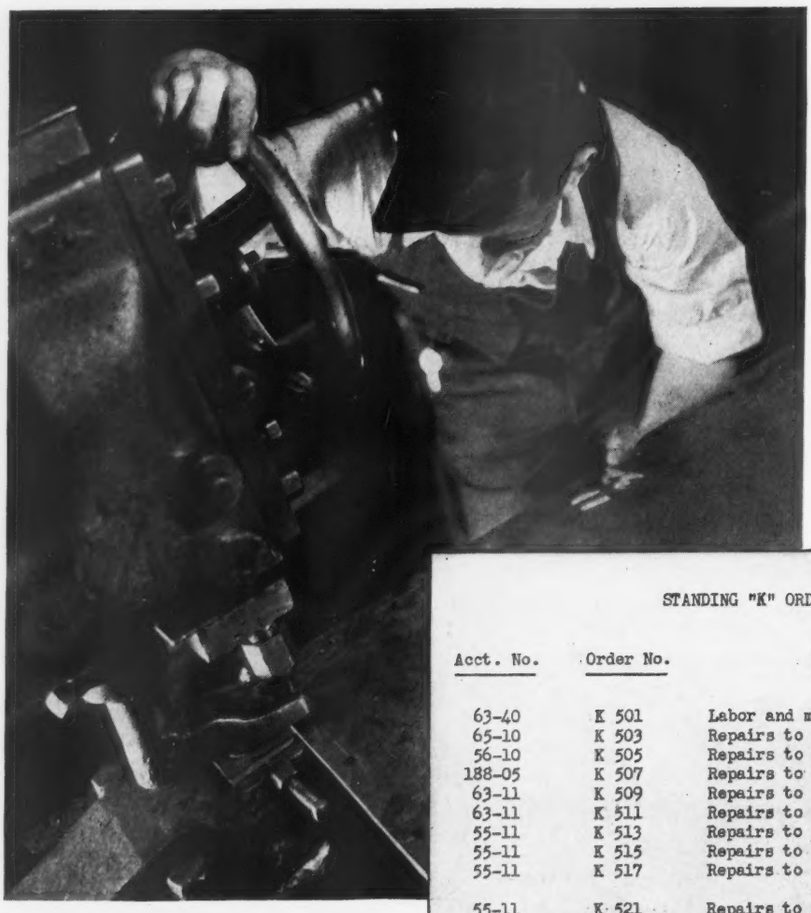


Here twelve 250-watt drying lamps, mounted 5 inches from moving belt, are used to dry cloth swatches on sample cards. Each card is exposed to the infra-red rays for 1 minute and 18 seconds, but usually is completely dry in something less than half that time

Sales Set This Maintenance

Capital goods manufacturer finds that budgeting is the only way to keep maintenance expense tied to sales volume; yet there's plenty of flexibility in his plan

JOHN BEALL
Maintenance Superintendent
American Blower Corporation
Detroit



Neglected maintenance will make this man on the production line idle. Budgeted maintenance is a form of insurance that this will not happen, for the budgeting technique forces consideration of the maintenance picture as a whole, and, while keeping costs in line, assures that jobs are planned in order of importance

Standing *K* orders (right) cover maintenance that must go on continuously. All orders in the list are charged to accounts in the maintenance superintendent's budget, and at the end of each month the accounting department compares actual expenses with amounts that have been budgeted for each maintenance account

WE AIM A DOUBLE-BARRELED CHECK at maintenance expense—it's budgeted in the first place, and then we split up responsibility between the manufacturing department foremen and the maintenance superintendent. Foremen are interested in the amount of maintenance done in their departments, and the way it is done, because the amount of maintenance they require affects their departmental budgets. Theirs is the responsibility for keeping expenditures on special departmental equipment in line, but on general factory equipment the maintenance superintendent bears the responsibility for estimating expenditures and staying within allowances set.

To keep tight control of maintenance

STANDING "K" ORDERS - JUNE 1, 1939

Acct. No.	Order No.	Nature of Work
63-40	K 501	Labor and material for safety work
65-10	K 503	Repairs to plumbing, drains, sewers, and water mains
56-10	K 505	Repairs to all factory buildings
188-05	K 507	Repairs to all office buildings
63-11	K 509	Repairs to all machinery
63-11	K 511	Repairs to all belting
55-11	K 513	Repairs to all electrical power equipment
55-11	K 515	Repairs to all electrical lighting equipment
55-11	K 517	Repairs to all steam lines, heating systems, and equipment
55-11	K 521	Repairs to all air lines
55-11	K 523	Repairs to all gas lines
56-10	K 525	Repairs to sprinkler systems
63-11	K 527	Repairs to all line shafting
55-11	K 529	Repairs to all boiler room equipment
63-13	K 531	Repairs to all refuse cans and scrap boxes
63-11	K 533	Repairs to buzzer and annunciator system
63-15	K 534	Repairs to all factory trucks and tote boxes
188-09	K 536	Repairs to all office furniture and fixtures
68-15	K 538	Repairs and supplies to auto truck No. 1
68-15	K 540	Repairs and supplies to auto truck No. 3
63-15	K 542	Repairs and supplies to tractors
68-15	K 543	Repairs and supplies to delivery car No. 1
68-15	K 544	Repairs and supplies to delivery car No. 2
64-27	K 546	Repairs to all patterns
63-12	K 561	Repairs to all numbered tools and dies
63-12	K 562	Repairs to all unnumbered tools and dies
63-13	K 564	Repairs to all factory furniture and fixtures
	K 566,etc.	Miscellaneous shop orders (to be analyzed each month and used only on written authority of the Cost Department).

Budget

expense in our two Detroit plants is an absolute necessity with us, because our products, ventilating and air conditioning equipment, fall in the classification of capital goods, and substantial fluctuations in output are not unusual. To prevent unexpected losses from too heavy maintenance expenses we must relate those expenditures to sales.

To begin with, an accounting classification was established for all expense incurred in maintaining plant and equipment in running order. For the two plants the same classification is used, except for a distinguishing letter added to each account number to show which plant the account applies to. But as far as the plan of control is concerned, no further distinction needs to be made between the two plants.

As already indicated, maintenance expense that can be definitely tied to one department is budgeted to the departmental foreman, and he is required to estimate expenses by setting up his budget for repairs on the following items—machinery, belting, electrical power equipment, line shafting, numbered tools and dies, unnumbered tools and dies.

Budgeting General Items

All other items of expense are budgeted to the maintenance superintendent. And, like the departmental foreman, he must estimate the necessary expenditures for each item in his budget. These items are all concerned with general factory equipment that is common to more than one productive department. Some classifications in the maintenance superintendent's budget are shown on the preceding page.

Dividing the responsibility for initiating work between the foreman and the maintenance superintendent does not lessen the scope of the latter's activities. He actually does all repair work, of course, not only on general factory equipment and buildings, but on machinery in productive departments, even though the latter expense is budgeted to the department foreman.

There is one limit to his responsibility, however. A repair job under $50 may be done on his approval; any job that will exceed this amount is considered a major item and must be approved by the operating vice-president, after it has been approved by the superintendent and the works manager. This must not be taken to mean that no repair exceeding $50 is permitted after the budget is established, if it was not included in the budget. Obviously, the repair is made when needed, but such an item, not included in the budget, is outside the routine. These extraordinary sums are included in the budget in a special way which will be explained later.

Two classes of orders, designated by the letters *K* and *X*, are used to accumulate maintenance expense. Regular or ordinary maintenance work is charged to the *K* orders, while special items costing in excess of $50 are changed to *X* orders.

The budget is set up for a year in advance, monthly for six months and in lump sum for the remaining six months. Revision is made, however, each quarter.

Two factors unite in fixing maintenance expense. The first is the accumulated experience in the accounting department, and the second is a statement of estimated maintenance needs prepared by departmental foremen for machinery and tools, and by the maintenance superintendent for general factory equipment.

As indicated before, the size of the maintenance budget depends on sales. The ratios of net sales in past years to each of the maintenance expense accounts in those years become guides for setting the budget. In the estimated net sales figure is included any anticipated inventory change. If inventory is to be adjusted upward, the net sales figure is increased; if downward, net sales are reduced.

With the net sales estimated by products for the period to be covered by the budget, it is possible to determine the productive hours required in each department. This fixes the productive load on each department. Again experience is called into play; in the past the amount of maintenance expense, or the amount of each maintenance account, has exhibited a certain ratio to productive hours worked in the departments. Consequently, it is this ratio that in a large measure governs allowances for each maintenance account in the budget.

General factory maintenance accounts, for which the maintenance superintendent is responsible, may be budgeted according to the sales-maintenance expense ratios, without the necessity of considering productive hours.

After the accounting department has made its estimates, each productive foreman and the maintenance superintendent submit their estimates for the next year. These estimates are made according to "Standing *K* Orders" (see cut), or divisions of maintenance accounts. All estimates then are brought together, and compared with the accounting department's estimate.

But one type of expense has been omitted, the items upon which the cost will exceed $50. Should it be deemed desirable to overhaul a boiler or a large press during the coming year an "*X* or *K* Order Request" must be made out, and approved as previously described. On this request appear a description of the work to be done, quotations on the job by outside concerns, and estimated total cost. If such a request is granted by the management, a work order is issued for it. The accounting department, after deciding on the appropriate account to which the order should be charged, adds the estimated cost to the allowance for that account, and the new total constitutes the budget for that account for the year.

How Orders Originate

When maintenance work is to be done on the request of a departmental foreman, he writes up an odd job order in duplicate—one copy for the maintenance department and one for his record. When approved by the superintendent, the work is performed by the maintenance department, and the order and all time cards and requisitions are marked with the proper standing *K* order number. All such accumulations are totaled, and a monthly report is prepared by the accounting division showing accumulated charges against each account. This is compared with the budget allowance.

The same procedure is followed when the maintenance superintendent wants to repair some item of general factory equipment for which he is responsible. He initiates the odd job order in this case, however.

Special *K* order requests for jobs above $50, which result in approved work orders, are checked as individual items. The actual expense is compared with the estimate.

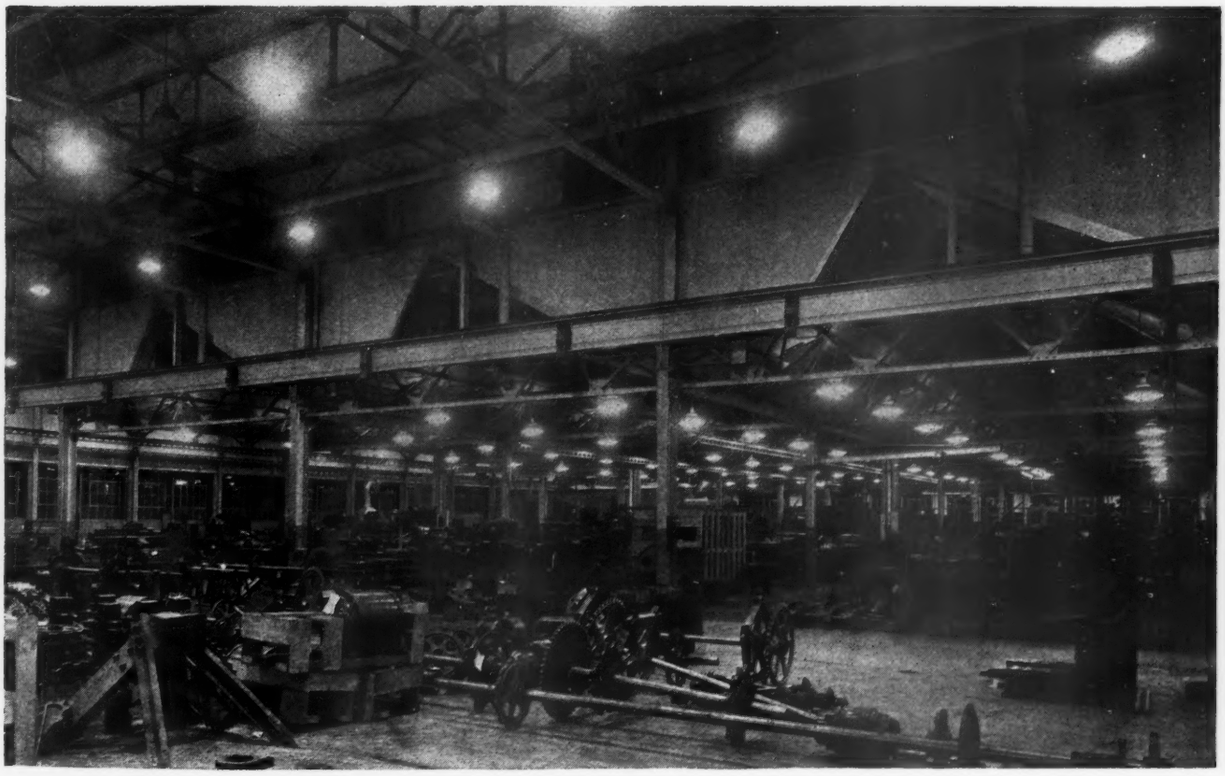
It must be realized that the budgeted amount in each maintenance account, against which actual expenses are compared, fluctuates from month to month with variations in production volume. The ratios worked out by the accounting department are applied to varying sales volume, and they, together with the extraordinary items, provide norms to guide actual expense.

They Profit by Good Lighting

Bowl-silvered 200-watt lamps in 20-in. porcelain-enameled reflectors (Goodrich) give 20 foot-candles intensity in an envelope plant. Fixtures are spaced 10 by 10 feet, and mounted 10 feet high. About 10 per cent of the light goes up, to give better distribution

Assembling tractors is one of many manufacturing operations that require good lighting. It is provided in this plant by Cooper Hewitt (G. E. Vapor Lamp) tubes. Fixtures are spaced 10 feet apart in one direction, 15 feet in the other. Mounting height is 15 feet

There is no complaint about poor lighting in this diesel engine plant. Alzak aluminum, high-bay reflectors (Westinghouse) with 500-watt lamps provide about 14 foot-candles. Reflectors are spaced 18 by 20 feet, mounted 25 feet high to clear overhead crane



An intensity of 45 foot-candles cuts accidents and errors in a plant making materials handling equipment. Fixtures are 400-watt, high-intensity mercury vapor Glassteel diffusers (Benjamin) mounted 20 feet up on 18-ft. centers, and high-bay mercury lamp units

Couldn't Run Without Instruments

Portable test instruments are kept busy checking motor loads and locating trouble

HERE'S HOW THEY HELP

1. Permanently installed instruments keep a continuous check and double check on condition of production machines

2. Assure not only efficient operation but also economical use of power—which is the main source of saving

3. Portable test outfits locate defects, check power loads, guarantee efficient operation of 2,000 motors

4. Are major factors in guaranteeing uniform quality

JOHN C. KUHNS

Power Plant Engineer, A. E. Staley Manufacturing Company, Decatur, Ill.

VISITORS TO OUR PLANT often express surprise at the large number of electrical instruments in evidence, even ask us why on earth we have so many. Our standard answer is that we do not see how we could run our plant without them. Lacking electrical instruments to tell us the various answers that we are continuously obtaining from them, we should feel as though we were groping our way in the dark. And like even the most careful groper, we should doubtless find ourselves in frequent and sometimes serious trouble.

Based on long experience in using lots of instruments, we believe that they repay their cost more quickly and surely than most classes of plant equipment. We might have difficulty in proving this with facts, since we have never bothered to keep a running record of the money they save us. But we know that the day-in and day-out economies that come from having an instrument mounted at a machine to guide the operator to optimum operating conditions, plus the assistance it provides in giving the supervisors a quick, sure check-up on operations, are enough to amortize the cost and installation expense in very quick order.

Add to this the occasional instance where an instrument gives us a really substantial saving we might not have achieved without it. Such a saving has frequently amounted to the cost of 50 instruments. Superimpose upon such savings the unquestionable decrease in the number of emergency situations that would almost surely arise without instrument control on processes, speeds, feeds. Even though we lack a statistical abstract of the profits inherent in using instruments, we seldom have to give up before any doubter is convinced that our policy pays.

The Stitch in Time

The obvious savings from electrical instruments come from power savings. But there are at least equally important savings arising from such purely production sources as uniform quality, steady rate of output, avoidance of breakdowns and other interruptions to continuity of operation. On the maintenance side, instrument control greatly reduces repairs on motors and on production machines by enabling us to take the necessary stitch in time.

Each example that will be given here might as well be taken from any one of a dozen other operations in the plant. Those chosen are merely typical of one class of instrument application. After all, the specific machine or operation may be one of highly specialized application to a few industries. The principles underlying these applications, however, may be just as valuable in lines of manufacturing wholly unrelated to the processing of corn and soy beans, which happens to be our business.

For example, each of our expellers has on it an indicating ammeter. Originally the ammeter was placed at the starter. Then for a while we mounted them at the feed adjustment on the other end of the machine. Now the ammeters are back at the starter position, because we found that that was the better place for them.

Primary purpose of these instruments is to keep the load of the machine right up to, but not above, rating. Almost as important, they indicate any mechanical defects that cause overload. Excess friction may develop or bearings go bad. If the feed has to be reduced to keep from an overload, as shown by the ammeter, then we know there is mechanical trouble and get right after it. If an overload develops, a relay kicks out, rings an alarm, and lights up a telltale that can be seen from practically anywhere in the building. Before these alarms and ammeters were installed an expeller might be out of production for a while before it was noticed.

The machine operator's job is to see that the ammeter on his machine gives the proper reading. The department foreman's job includes seeing that ammeters are indicating a high enough activity. The consequence is that machines are kept running right at capacity, and whenever any trouble is

brewing in machine or motor we get warning so early that we can usually fix it before it has a chance to become serious.

Another typical ammeter installation is on the blowers that unload material direct from the elevator. This meter is used, as on large equipment throughout the plant, to indicate abnormal conditions. When everything is properly adjusted, the meters show full load on the motors. When there is an overload, or obstruction in the line, or anything goes wrong, it shows up on the instruments —and we go fix it before it causes damage.

Before instruments were applied here we had an occasional breakdown that was serious. Such a breakdown might require expensive repairs. But the loss of production in the department that broke down and in all the departments behind it that had to go home until operation could be resumed was much greater. Now such breakdowns are rare, and when we get one it is on a smaller scale and takes less time to repair.

Mills for grinding the meal also have ammeters on them. We have several mills running, precisely tied into the total production schedule of the plant. Without instrument control we could easily underload one mill and put an overload on others. Instruments help us to equalize the loads. It is, however, not so simple as it sounds.

For example, excess moisture in the material overloads a mill, may require that we throw an extra mill into the line. If material begins coming drier than usual, we may be able to pull one mill out of production. Always, of course, we go back to the moisture control point in a preceding department and try to get the moisture regulated to the optimum operating condition.

Show Moisture Content

In the operation of grinding finished product, the moisture content is part of the quality control. The instruments, by their readings, give the operating men so sensitive an index of moisture that despite laboratory controls exercised throughout the plant, the ammeters sometimes indicate excessive or insufficient moisture content before the control laboratory gets a sample.

Throughout the plant we have test jacks at the big motors to permit quick use of testing instruments. By means of a portable instrument kit we get readings of voltage at the motor, current input, power factor, kilowatts, and frequency. We make these checks to see that we have the proper motor application for the type of load. As soon as we install a machine for which we do not definitely know the proper size of motor —mind you, we have learned from sad experience that the machine manufacturer does not always have it right—we check the motor and if necessary change it. If a motor kicks out, we hook up the instruments and see what caused it.

Sometimes the cause is a change in the operating characteristics of the machine. Occasionally a department somewhere ahead has made a change in its methods without forseeing that it would change conditions for the subsequent department. The cause may be a defective motor, or excessive voltage drop that requires a change in the feeder or power factor correction.

Periodic Motor Checks

Our aim is to check practically all motors periodically as required. The frequency of checking depends upon how sure we are of the application.

One specialized application of the testing instruments has been in raising our standards on pumps. We went through our plant and checked all our pumps for the motor application and for proper size and efficiency of equipment. In some instances we cut power consumption greatly by changing from inefficient pumps to others that did the work with less power, as well as by better motor application.

Check of motor loads on pumps often shows that the pump has become worn enough to need repairs, a fact which otherwise might not show up until serious damage was done. With many kinds of machinery, bearing wear may let a part drag. When we investigate why the load has increased, we find out lots of things of this sort.

We also have two portable recording ammeters, used principally to find causes of trouble. If we are having difficulty with a machine, we resort to the recording ammeters. These instruments show the time and extent of the difficulty. Then we find its source.

Occasionally the mere installation of the recording instrument at a machine stops the trouble; then we know that the difficulty was with the human element, and that the individual responsible for it changed his practices as soon as he saw the instrument in place, knowing that it would report everything impartially.

One of the recording ammeters is in use practically all the time. Often two are at work. And nine times out of ten, the instrument gives us a record that is sufficient to solve the problem.

We also have two clamp-type ammeters which we use on motor leads and feeders when we wish to find out whether a motor or line is overloaded. They, too, are in almost continuous use because they give us a countless number of facts we need.

In our plant at Decatur we have literally thousands of electrical instruments, of which by far the greater number consists of ammeters mounted on the production machines. We have 2,000 motors. Not all have permanent instruments, but there are many instruments on main feeder lines, departmental circuits, and so on. These line instruments are used for cost accounting as well as for assuring efficient operation and economical use of power.

John Kuhns has had lots of jobs but only one boss—Staley is the only concern he's ever worked for. Kuhns finished three years of electrical engineering at Illinois, just in time to get a taste of military service on the Mexican border; it didn't discourage him from coming back for more in the World War.

Right after the Armistice he signed up with Staley. For ten years he held down various jobs—efficiency engineer in the boiler plant, production superintendent, assistant industrial engineer. In 1929 he settled down in his present work where, because the power engineer has to work with practically every department in the plant, he never regrets the years he spent on those miscellaneous other jobs

Is This the Plant of Tomorrow?

Does Johnson Wax's startling new office building, like a factory in many ways, indicate new trend in plant design?

J. F. ANDREWS
Assistant Editor

WHAT THE FACTORY OF TOMORROW will look like may be forecast in the new building recently opened by S. C. Johnson & Son, Inc., at their Racine, Wis., plant. Designed by Frank Lloyd Wright to house the company's general and executive offices, the structure approximates a factory building in many ways.

It is windowless. Natural light enters through skylights and two glass bands that encircle the building, one 6 feet above the floor, the second following the rim of the ceiling. All glass is of the diffusing type.

Heart of the building is its one large sound-absorbent workroom measuring 210 by 130 feet. Girdling the office is a mezzanine gallery 7 feet off the floor, on which are located the offices of department heads and junior executives. Above a portion of the main floor is a second floor or penthouse unit containing the chief executives' offices. A squash racquets court and a theater for sales meetings and entertainments are located on this second floor.

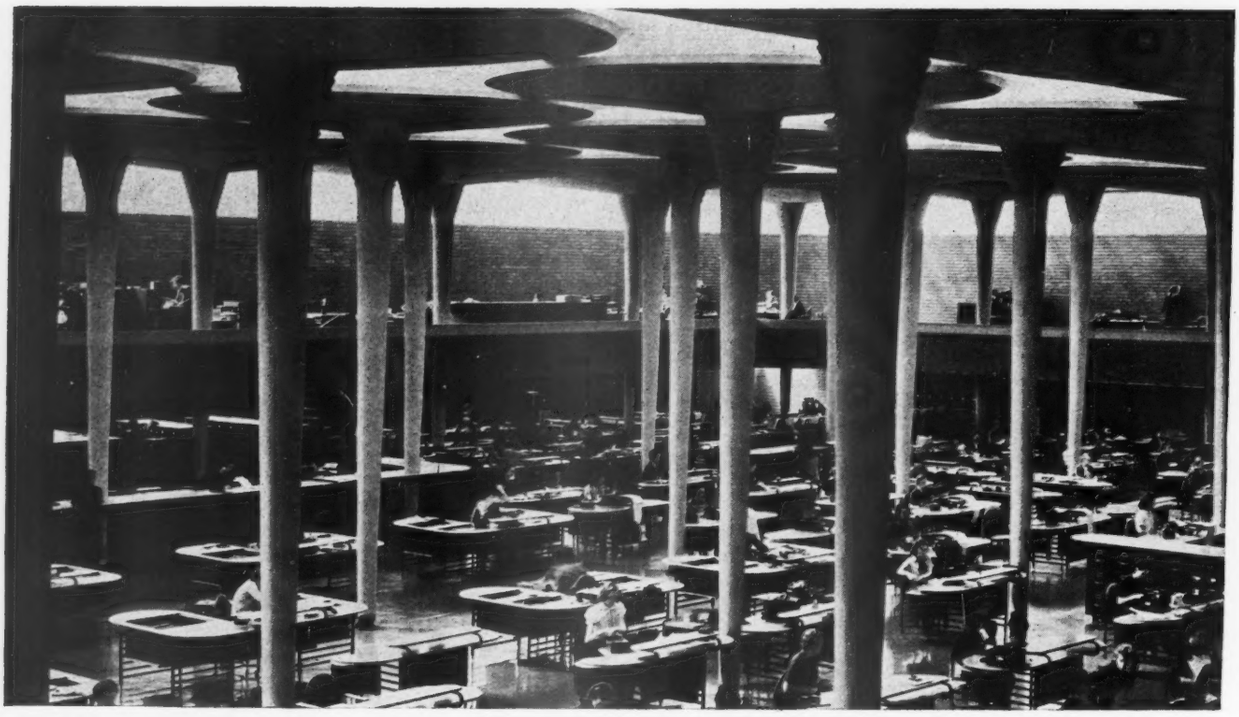
Of course the building is completely air conditioned summer and winter. Heating is by means of brass steam coils laid below the concrete floor in such a fashion that they convert the floors themselves into radiators.

Service facilities—lockers, toilets, and so forth—are in the basement, with separate facilities provided for persons in the mezzanine and executive offices.

A real innovation is the "car port," a commodious car-parking lot for employees' and executives' cars, which is equipped with practically all garage facilities. Opposite this parking area is the building entrance, reached by driveway and sidewalk from the street, with entrance doors sheltered beneath a passageway so that people alighting from cars are protected from the weather.

Construction is materially different from accepted design. A horizontal unit system 20 feet on center is used, giving bays of 400 square feet within each square of four columns. The columns themselves are of extraordinary design —they resemble inverted golf tees. Their slender monolithic shafts taper in decreasing diameter toward the base, while the widespreading shallow tops flare out umbrella-like to support the roof and second story.

Most interesting from the standpoint of interior appearance is the fact that there has been no decorating. The building's structural members are frankly exposed; there is nothing concealed or glossed over to hide the functional nature of the building materials. This absence of any kind of decoration or concealment has eliminated all necessity for corridors or other waste space; all space is open and working.



Obviously graceful and space saving, columns are strong as well. Light areas in the ceiling are glass, through which light enters

MAINTENANCE SERVICE SHORTS

Readers are invited to contribute brief illustrated articles reporting out-of-the-ordinary maintenance accomplishments. Accepted articles will be paid for

BUILDINGS AND SERVICES

Hot Bearing Alarm Signals Increase in Steam Load

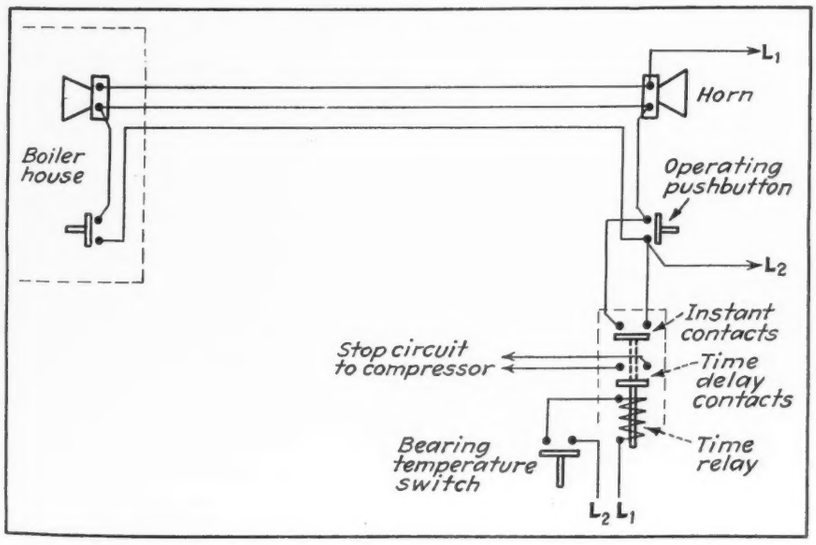
GILBERT LINDGREN, *Electrical Foreman*
Hudson Valley Fuel Corporation
Troy, N. Y.

Heavy demands for steam, when imposed without warning, may cause a decided drop in steam pressure, or otherwise upset normal operation of the plant.

To guard against such contingencies, we connected the hot bearing alarm and the shutdown alarm on a 600-hp., motor-driven compressor to a horn in the boiler house. If a bearing becomes overheated or a shutdown occurs from other causes, the boiler house attendant is automatically notified to be prepared for an additional steam load. A diagram of the connections is shown in the sketch.

It will be seen that this arrangement embraces:

1. A signal system between the boiler house and compressor room.
2. A hot bearing alarm for the compressor operator.
3. An automatic signal to notify the boiler house of a probable increase in the steam load.
4. A definite time delay before the compressor is automatically shut down because of an overheated bearing.



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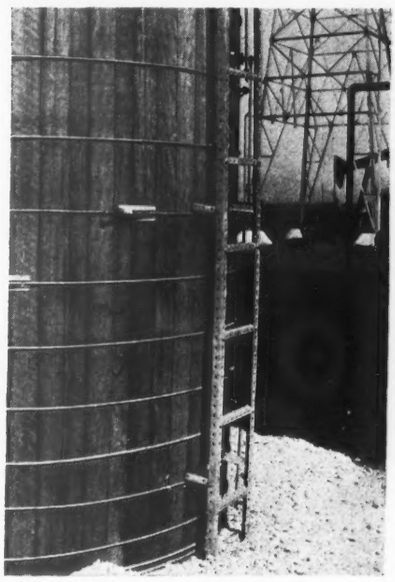
Yard Ladders Easily Made from Perforated Angles

ELTON STERRETT, *Longview, Tex.*

Light angle-iron sections used for reinforcing demountable tanks can be used to good advantage in building both portable and fixed yard ladders. With a hacksaw, crescent wrench, and a few short bolts of the proper size to fit the perforations in the angle, a ladder can be built with any desired spacing of the rounds, depending on whether the men using it are to climb empty-handed or must carry a load.

Short sections of the angle with the web sawed free from the flange may have small feet formed on them and be used, as shown in the illustration, to hold the ladder away from the structure on which it is used, thus affording toe room and permitting inspection and maintenance under the ladder.



Where a portable unit is desired, the top may be given a reverse or hooked end, so as to engage the top of open tanks or the toeboard of walkways.

Such a ladder is lighter than a wooden one of equal strength, is weatherproof, and can be made sectional for transportation in a service truck, without sacrificing strength or becoming cumbersome at the joints.

•

Water Spray on Office Roof Keeps Worker Efficiency Up

R. C. STARK, *General Superintendent*
Pratt & Lambert, Inc., Buffalo, N. Y.

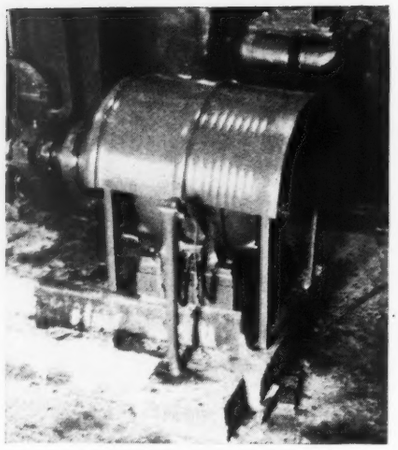
Our factory office is located on the top floor of one of the manufacturing buildings. During the summer months the excessive heat caused by the sun beating on the flat roof made working conditions most unpleasant, to say the least.

Air conditioning seemed to be out of

the question because of the expense involved. We considered the possibility of putting a canvas covering over the roof to protect it from the direct rays of the sun, but even this expedient would have been very costly because of the large area.

In another part of the plant a considerable quantity of water is used for cooling purposes. This water is recirculated during the winter months but in summer, because of the higher temperatures, it is sent to the sewer after it has served its purpose.

We conceived the idea of running a 1½- and a 1¼-in. pipe to the roof of the factory office building and connecting to them ¾-in. and ½-in. pipes equipped with inexpensive spray nozzles made up in our own machine shop. Then by using the pump on the circulating system we were able to spray the cooling water over the office roof, reducing the temperature to a point where working conditions are most pleasant on the hottest day in summer. As a result, everyone is now able to work in comfort, and quality and volume of work done in the office have increased considerably.



POWER AND LIGHT

Save $12,000 by Keeping Power Demand Down

SOURCE

Zenith Radio Corporation, Chicago

To hold power and lighting costs at a minimum this plant has a contract with the central station from which it purchases its power, specifying a lower rate if a stated maximum demand is not exceeded during the public service company's period of peak demand. Each incoming line is separately metered, and the specified demand may not be exceeded on any one of these meters during the hours of 4:30 to 7 p.m. from November 1 to March 31.

A man is stationed in the switch room during these hours in the months specified. His sole duty is to watch the demand shown on each of the meters. If he sees it getting within a hair's breadth of the maximum, he telephones to the department that is using too much current, or goes there and tells the foreman his kilowatt-hour load is building up to the point where the higher rate takes effect. As the load allowance is calculated every half hour, the foreman shuts down where he can so as to lighten the load until the end of that half-hour period.

The usual cause of a close approach to an excess demand is someone's failure to notice that it is 4:30—perhaps an engineer conducting some researches with a big power demand, or a production department that has all of its heavy machinery operating simultaneously. It is the responsibility of each foreman or department head to schedule his work to avoid this excess. Since the advantage to the company's electric bill is $12,000 if the specified maximum is not exceeded during the season, it is highly profitable to keep the one man on guard duty for 2½ hours each day during five months of the year.

•

Old Steel Drums Make Good Covers for Motors

NEIL K. BANGS, *Chief Electrician*
The Fox Paper Company
Lockland, Ohio

A simple and neat method of covering motors, but which allows ample room for ventilation and oiling, is shown in the photograph.

This inexpensive cover is made by cutting an empty steel drum longitudinally in half, leaving part of the bottom for end protection. A piece of narrow angle iron is then bent to conform to the arc of the drum, and extended beyond to form feet. The ends of the feet are bent over and drilled for mounting bolts, which hold the cover firmly in place. It is suggested that brass bolts be used, since they do not rust and can, therefore, more easily be removed when necessary.

A coat of machine tool gray paint will improve the appearance and protect the covers from rust.

Covers such as this will save many times their cost by protecting motors from dripping water and falling objects.

•

Timesaver on a temporary machine installation: Motor base was bolted to floor in only one corner. Motor can be pivoted on this bolt until belt travels on center of pulley. A wedge between diagonally opposite corner of the base and a wood block bolted to the floor holds base firmly in place.

•

Turning Down Riser Bars Invites Future Trouble

ED. SWAN, *Kearney, Neb.*

From my experience in repairing motors and generators it seems to be altogether too-common practice to turn down the riser bars on armatures so far that the leads are just about cut in half. The object, of course, is to make a neater-looking job.

Neatness of appearance is obviously desirable, but when it is obtained at the sacrifice of reliability of operation, one pays too high a price for it. In this instance there can be no question that turning risers down too far considerably increases the likelihood of trouble later.

If care is taken to do a neat job of soldering the leads, there will be no need to turn the bars down.

MOTOR TROUBLES
Symptoms, Causes, Remedies

Prepared by
THE MASTER ELECTRIC COMPANY
Dayton, Ohio

A. MOTOR WILL NOT START ITS LOAD

CAUSES	Symptoms: *Determine by inspection*	*TESTS AND REMEDIES*
1. No voltage at the motor terminals.		1. See if lights on the same circuit burn or connect test lamp across motor terminals with motor switch closed.
2. Low line voltage.		2. Check voltage. If abnormal voltage drop in service lines, rewire circuit with larger wire.
3. Fuses blown (See E).		3. Check size and condition of fuses.
4. Poor contacts or connections.		4. Examine and tighten all loose connections.
5. Brushes not set properly.		5. See that brushes seat well on the commutator and are free to move in their holders. Check the brush setting.
6. Motor connected to the wrong power circuit (See K).		6. Check nameplate data.
7. Motor terminals not properly connected to the power circuit.		7. Check motor line connections.
8. Service lines or transformer, or both, too small.		8. Check transformer. (Also see No. 2 above).
9. Motor overloaded.		9. An overload usually causes the speed to drop below nameplate marking.
10. Shorted, grounded, or open windings (See J, K, and L).		10. See J, K, and L.
11. Worn bearings allowing the rotating part to drop down on the stationary field.		11. Inspect bearings for tightness and lubrication.

B. MOTOR SEEMS TOO WEAK—RUNS SLOW

1. Low voltage at motor terminals.	1. See A-2.
2. Motor overloaded.	2. Remove load. If motor operates at rated speed check bearings for tightness and lubrication.
3. Poor contacts or connections.	3. Check all contacts at main switch or auxiliary switches used to operate motor. Clean commutator and make sure that the brushes are free in holders.
4. Motor connected to the wrong power circuits.	4. See A-6.
5. Motor improperly connected to circuit.	5. See A-7.
6. Motor windings damaged (See J, K, and L).	6. See J, K, and L.

C. MOTOR RUNS TOO FAST

1. High voltage.	1. Check voltage on line.
2. Motor connected to wrong circuit.	2. See A-6.
3. Motor terminals improperly connected to circuit.	3. See A-7.
4. Frequency too high (a.c. motors only).	4. Determine frequency stamped on motor nameplate and check with power source.
5. Motor windings damaged (See J, K, and L).	5. If d.c. motor test for open shunt field circuit.
6. Motor too lightly loaded.	6. Series, repulsion, and universal motors may run too fast if load is too light.

D. MOTOR RUNS TOO HOT

Symptoms: *Distinct odor of burning insulation*

1. Motor overloaded during starting and running period.	1. Remove load, run motor idle. Give it a general inspec-

MOTOR TROUBLES
Symptoms, Causes, Remedies

CAUSES — *TESTS AND REMEDIES*

D. MOTOR RUNS TOO HOT (Continued)

2. Line voltage too high.	tion. Apply load gradually and note characteristics. Inspect for localized heating.
3. Line voltage too low.	2. See C-1.
4. Belt too tight or coupling or gear out of line.	3. See A-2.
5. Insufficient lubrication.	4. Adjust belt, gear, or coupling.
6. Faulty commutation (See F).	5. See I.
7. Motor windings damaged.	6. See F-2.
8. One fuse blown in two- or three-phase motor circuit allowing motor to operate on one phase (single phase).	7. See J, K, and L.
9. Ventilation obstructed or restricted.	8. If trouble not eliminated check windings for defects (See J, K, and L).
	9. Remove cause of obstruction.

E. MOTOR FUSES BLOW

Symptoms: *1. Motor stops*
2. Motor gets hot
3. Motor refuses to start

1. Motor overloaded.	1. See D-1.
2. Fuse too small.	2. Check fuse information sent with the motor.
3. Motor connected to wrong power circuit.	3. See A-6.
4. Motor improperly connected to circuit.	4. See A-7.
5. Damaged motor windings.	5. See J, K, and L.

F. FAULTY COMMUTATION

Symptoms: *1. Excessive flashing*
2. Blackened commutator
3. Brushes wear rapidly

1. Protruding mica or rough commutator.	1. Remove armature and have a thin cut taken off the commutator with sharp lathe tool.
2. Dirt or oil on commutator.	2. Clean commutator with a soft rag.
3. Brushes stuck in holders.	3. Make sure brushes ride easily in their holders.
4. Wrong brush position.	4. See A-5.
5. Weak springs.	5. Replace springs.
6. Overloaded motor.	6. See A-9.
7. Motor windings damaged.	7. See J, K, and L.
8. Reversed commutating pole connection (d.c. only).	8. Make connection correctly.

G. EXCESSIVE BRUSH WEAR

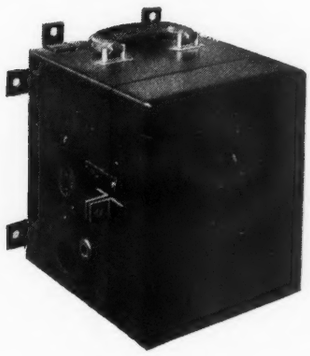
Symptoms: *One set of brushes should function satisfactorily for at least 2,500 running hours*

1. Excessive sparking or flashing at the brushes.	1. Inspect condition of commutator, also brush spring tension.
2. Wrong quality brush.	2. Replace brushes to insure proper commutation.
3. Rough commutator or high mica between the commutator bars.	3. If mica segments protrude take a thin lathe cut from commutator. Polish with No. 00 sandpaper. Use no oil.
4. Overloads.	4. See A-9 and D-1.

TO BE CONCLUDED IN THE AUGUST ISSUE

Like installing streamlined trucks . . .

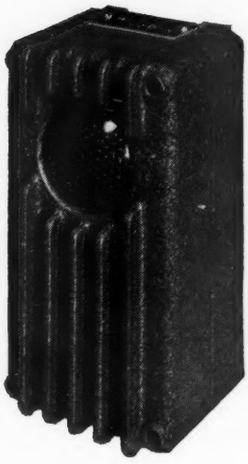
The Exide System handles more materials FASTER!



YOUR electric industrial trucks can now handle more materials, handle them faster, and do so at lower cost. This is made possible by Exide-Ironclad Batteries plus the new efficiency equipment developed by Exide—in short, by the Exide System.

The system begins by determining scientifically the size and type of battery needed, providing the right Exide-Ironclad for your particular job. These batteries, now compactly assembled in steel trays, are available in capacities up to 1000 ampere-hours and more, capable of handling ten to fifteen ton loads with speed and ease.

To avoid delays, cut "tow-ins," and keep the service operating at most efficient speeds, the Exide Discharge Indicator mounts on your truck, flashing visual warning when the battery nears the discharge point. And to eliminate wasted time as well as needless trouble in charging your Exide-Ironclads, the Exide Charge Control Unit mounts on your charging panel, automatically controlling the rate of charge, then cutting the circuit and flashing a signal when the charge is complete. Why not write for full details today?



THE ELECTRIC STORAGE BATTERY CO., Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
Exide Batteries of Canada, Limited, Toronto

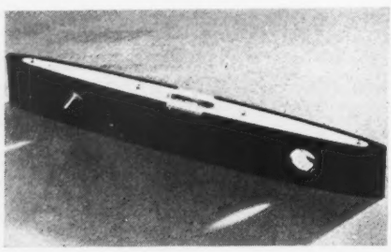
You Want to Know

more about the items mentioned on this page.
Letters to the addresses given will bring information

• PLASTICS—what they are, how they can be used, which type best serves a given purpose—are subject of a businessman's guide to plastic materials. Bakelite Corp., 247 Park Ave., New York.

• ASPHALT ALUMINUM PAINT, ready-mixed, applicable indoors and out, can be put on directly from the container. Asphalt, tung oil, and fine aluminum paste are its ingredients. American Asphalt Paint Co., 43 East Ohio St., Chicago.

• FIRE EXTINGUISHER, carbon dioxide type, can be held and operated by one hand. It has pistol-grip handle, trigger control valve, and discharge horn that locks in any one of several positions. Walter Kidde & Co., Inc., 140 Cedar St., New York.



TODAY'S EMPHASIS on design and the application of new materials to long-used products has dressed up our old friend the level. Molded black plastic went into this trim tool because of its light weight and ability to resist abrasion, heat, and moisture. Miller Falls Co., Greenfield, Mass.

• FLEXIBLE COATING, made of a combination of synthetic resins, is highly resistant to alkalis, acids, and oils, has high dielectric value. Plating tanks, pipe lines, electrical equipment, and metal exposed to corrosive conditions are some of its applications. Paramount Rubber Service, Inc., 1430 Rosedale Court, Detroit.

• FOGGY GOGGLE LENSES don't have to be that way. Wipe both sides of the lenses with chemically treated "fog-gle" cloth that cleans, polishes, and retards fogging. Industrial Products Co., 800 West Somerset St., Philadelphia.

• FLEXIBLE LACQUER that can be brushed or sprayed on canvas belts to make them smooth and resistant to oil, dirt, grease, and moisture, has special value for food plants, because smooth surface it imparts to belts lessens danger of bacteria lodging in the fabric. Roxalin Flexible Lacquer Co., Elizabeth, N. J.

• FLOW INDICATOR for oil-circulating lines on machinery, indicates a plug-up between the pump and bearing by means of an indicating hand that moves to a "danger" zone marked on the dial. Industrial Instrument Co., 96 East Miller Ave., Akron.

• METAL CLEANER, a solution, removes plain or baked paint and lacquer finishes without dissolving coating or effecting plated undercoatings. American Conveyor and Equipment Co., 960 Rising Sun Ave., Philadelphia.

• HARDNESS CONVERSION TABLE for nickel alloy steels, revised, shows Brinnell, Vickers, Rockwell, Shore equivalents. It includes S.A.E. specifications for the different nickel alloy steels. The International Nickel Co., Inc., 67 Wall St., New York.

• CRANE USERS, and plants thinking of installing their first crane, will find "How to Write a Traveling Crane Specification" a helpful little booklet. Whiting Corp., Harvey, Ill.

• IF you've ever spent time pondering the importance of machine tools, and counted up the number of things you'd have to get along without were there no machine tools, you'll want to read "Machine Tools and You," which tells all about the machine tool industry. National Machine Tool Builders' Association, 10525 Carnegie Ave., Cleveland.

• REFRACTORY MATERIAL, applied by trowel, brush, or gun to damaged furnace linings, makes tearing out and rebuilding the interior unnecessary. It's air setting and comes wet or dry. Laclede-Christy Clay Products Co., St. Louis.

• HOISTING, pushing, clamping, bracing, removing gears and pulleys, spreading and pulling together structural members, are all within the abilities of a multiple tool whose several parts can be used in various combinations to do countless jobs. Templeton, Kenly & Co., 1020 South Central Ave., Chicago.

• GLOW LAMP RECEPTACLE is streamlined so that exposed portion of the lamp has the appearance of a lens. Lamp breakage is reduced because only a small portion of the lamp remains exposed, although the lamp's effectiveness as a signal or exit light is not impaired. General Electric Vapor Lamp Co., Hoboken, N. J.

• MANAGEMENT ENGINEERS should determine quantity and condition of inventories, leaving pricing and the inventory statement to the accountants, says a pamphlet that attempts to clear up some of the confusion over the responsibility for confirming inventories. Association of Consulting Management Engineers, Inc., 347 Madison Ave., New York.

STEAM at 350 deg. F. blows from these tiny 9¼-in. boilers 15 seconds after operation starts. Made in 1,000, 1,500, and 2,000-watt sizes, with evaporating capacities up to 5.7 lb. of water per hour, it may be used in plants and laboratories for sterilizing, distilling, and supplying steam for small-scale processes. Westinghouse Lamp Division, Westinghouse Electric & Manufacturing Co., Bloomfield, N. J.

• SLIDE RULE combines many rules in one, although there is only one slide. Solutions to problems such as surface speeds, cutting speeds, diameters of cutters and drills, r.p.m. required, time-study calculations, can be worked out quickly on its six scales. Eugene Dietzgen Co., 2425 Sheffield Ave., Chicago.

• DEHUMIDIFIERS, consisting of cabinets and moisture-absorbent material, remove dampness from storerooms and processing rooms. Moisture absorbed forms a brine that flows downward through the filter bed and passes into a drip pan or drains. Aqua-Sorb Co., 21 South 16th St., East Orange, N. J.

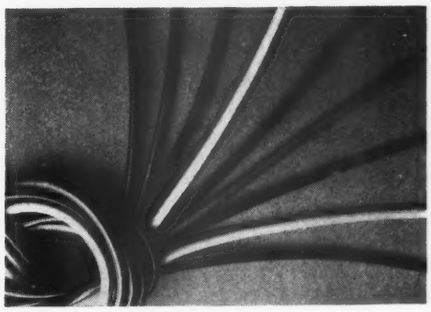
• CONCRETE FLOORS, dirty and oil stained, can be cleaned and made ready for painting with a solvent that extracts the oil as an emulsion. This emulsion is easily sluiced away with a water hose. The Curran Corp., Malden, Mass.

How to do it?

Here are some recent G-E developments that may help you

TEST INSULATION QUICKLY

Just plug this device into a standard outlet, and you have a very convenient method for the testing of insulation of motors, appliances, etc. Output voltage can be varied from 500 to 3000 volts. It is safe, accurate, and easily portable. Use coupon and write today for publication GEA-3104.



MAKE YOUR WIRING OIL-PROOF

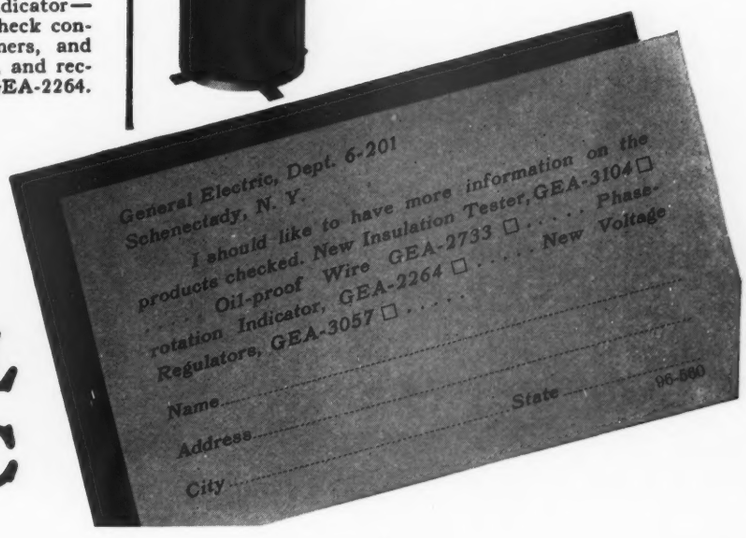
Ever have trouble with oil attacking rubber insulation? Here is a wire, insulated with FLAMENOL, that won't burn; it resists oil, acids, and alkalis. It's ideal for wiring machine tools and other high-grade equipment. Ask for our Bulletin, GEA-2733, which gives details.

CHECK FOR PHASE-ROTATION

You can save time with this phase-rotation indicator—predict direction of rotation of motor drives, check connections for paralleling generators, transformers, and buses, and check connections on meters, relays, and rectifiers. Easy to use. No moving parts. Ask for GEA-2264.

REGULATE SECONDARY VOLTAGE

A new line of G-E air-cooled regulators greatly widens the field of application in which uniform voltage control can be obtained economically. You can now have constant voltage on long secondary runs regardless of fluctuations in power load. You'll miss a good bet if you don't find out about these new regulators. Publication GEA-3057.


General Electric, Dept. 6-201
Schenectady, N. Y.
I should like to have more information on the products checked. New Insulation Tester, GEA-3104 ☐
Oil-proof Wire GEA-2733 ☐ . . . . . Phase-rotation Indicator, GEA-2264 ☐ . . . . . New Voltage Regulators, GEA-3057 ☐ . . . . .
Name
Address
City
State
96-590

GENERAL ELECTRIC

What's New in Equipment

Table

Table with top of tempered Masonite that is said not to split, peel, warp, nor become rough on the edges, comes in five heights from 20–29 in., and may be had with or without compartments. Metal parts are taupe enameled, oven baked. Royal Metal Mfg. Co., 1138–40 South Michigan Ave., Chicago.

Transformer Cooling Fan

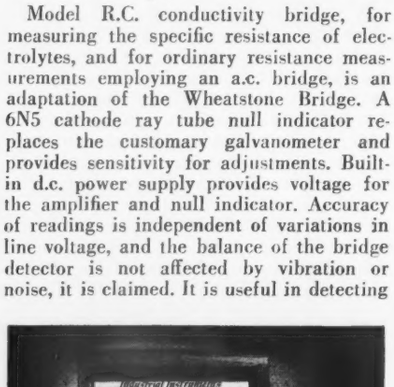
Portable, motor-driven, high-velocity, propeller fans, for cooling transformers, operate on a horizontal, or tilted on an angle up to 45 deg. above the horizontal. Adjustment of a screw in the motor base will hold the fan at the required angle. Safety guard protects the cast-aluminum alloy blades which are attached to welded structural-steel frame. A 1-hp. 3- or 2-phase, 60-cycle motor, for all standard voltages, operates at 1,750 r.p.m. It is water-tight and equipped with ball bearings. Capacity: up to 5,000 cu. ft. in free air; up to 3,000 cu. ft. with 1-in. static pressure. Weight: 145 pounds. Diehl Mfg. Co., Elizabethport, N. J.

Electric Gate Operator

Electric operators, Model Q and QR, for single- and two-leaf swinging gates, feature an automatically operated lock bar, heliocentric speed reducer that runs in oil, limit switch that shuts off the motor when the gate reaches the fully open or closed position, an adjustable friction clutch for protection of persons or objects coming in contact with the gate when it is in motion. Model Q requires that control switch be held closed during operation. Model QR is equipped with a relay and requires only momentary contact, and it may be controlled by a driveway plate or by radio control. Both models are suitable for standard wire-mesh gates up to 14 ft. in width, 7 ft. in height, or 1,000 lb. in weight. In controlling a 2-leaf swinging gate, a separate operator is applied to each leaf. Motors are available in single-phase a.c. or d.c. Model QR can be furnished with a 3-phase motor. A 1/6-hp. motor is standard. Barber-Colman Co., Rockford, Ill.

Conductivity Bridge

Model R.C. conductivity bridge, for measuring the specific resistance of electrolytes, and for ordinary resistance measurements employing an a.c. bridge, is an adaptation of the Wheatstone Bridge. A 6N5 cathode ray tube null indicator replaces the customary galvanometer and provides sensitivity for adjustments. Built-in d.c. power supply provides voltage for the amplifier and null indicator. Accuracy of readings is independent of variations in line voltage, and the balance of the bridge detector is not affected by vibration or noise, it is claimed. It is useful in detecting impurities in distilled water, and for the measuring of highly conductive solutions —acids and alkalis. The 14-in. scale has five ranges. Self-contained in a cabinet, it is portable. Operation is from a 110- or 220-volt a.c. power line, 25-60 cycles. Industrial Instruments, Inc., 162 West 23d St., Bayonne, N. J.



Intercommunication System

Model 302 "Twinphone" includes an executive's master station and 1–10 employee-substations, each able to originate calls to the master station as well as to receive them. Background noises are eliminated, it is claimed. A normal conversational tone, or even a whisper, it is claimed, can be heard without the use of earphones. Master station and substations are connected by a 3-conductor wire which carries no voltage. Only the master station need be plugged into the 110-volt a.c. or d.c. circuit. Executone, Inc., 415 Lexington Ave., New York.

Drives

"Masterdrive" line of drives, for machine tools and punch presses, combines gear-head motor and super-structure in one unit that can be attached to machine tools of usual designs. Wide variety of models ranging from ¾ to 5 hp. are available. The worm and gears run in oil. The drive, it is said, does not coast when power is shut off. Industrial Equipment Div., The Master Electric Co., Dayton, Ohio.

Testing Machine

Testing machine, for tensile, transverse, and compression testing, has a capacity of 60,000 pounds. The machine may be adapted for special purposes. Compression space may be increased and the screw and handwheel on top of the machine provide adjustment for tensile specimens of different lengths. Transverse table, posts, head, are full-floating while tensile testing, thus eliminating possibility of misalignment of specimen or friction in the ram. Load is applied hydraulically by means of a motor-driven pump. Rate of loading is automatically maintained by an auxiliary valve which may be set. Ram and cylinder are of

EXTRA VALUE FEATURES IN SSUNIT PUMPS MEAN

RECORD PUMPING ECONOMY FOR YOU!

Dollar for Dollar, Plants All Over the Country Get the Kind of Record-Breaking Pumping Performance that Makes Allis-Chalmers SSUnits Their First Choice!

IN THIS LARGE MIDWESTERN INdustrial plant, Allis-Chalmers SSUnit Pumps are playing a vital part in holding pumping costs to a new low.

It means pumping costs are knocked down to a new low . . . the way this fast-selling SSUnit pump performs in plants all over the country!

And yet it's only one of the reasons plant managers are switching to the pump Allis-Chalmers engineers — the same engineers who designed and built the gigantic Boulder Dam and Niagara Falls Turbines — originated in 1926 to revolutionize pumping practice . . . actually do away with old, money-wasting pumping methods!

Great Engineering Features! The new SSUnit pump is amazing them with its great engineering features! They call it outstanding . . . for its simple, compact design that beats space waste, cuts maintenance costs . . . for the complete protection against excessive wear and rust that bronze construction gives the enclosed runner, shaft sleeves, and wearing rings!

More Gallons with SSUnits! And they're 100 percent sold on the famous Allis-Chalmers Lo-Maintenance Motor that drives the pump . . . the Full-Measure Constructed Motor that's made a name for itself by standing up under conditions that many times wreck ordinary motors in a few weeks! No "buck-passing"...Allis-Chalmers accepts undivided responsibility for both motor and pump!

That's what they get when they install SSUnit Pumps in their plants! And that's what you'll get, too! But equally important . . . you get a pumping unit that's fully tested before it leaves the factory . . . your guarantee that it's ready to go to work for you the minute it's installed!

Get the whole story on the pump that gives you more gallons at less cost! Call the nearest district office . . . or write direct to Allis-Chalmers!

1108

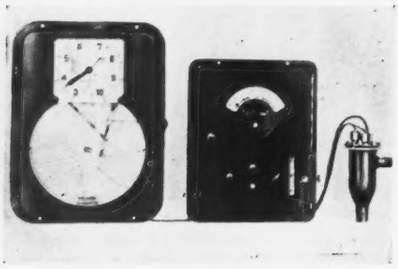
. . . 90 Years of Engineering Superiority Work for You When You Specify Allis-Chalmers!

CENTRIFUGAL PUMP DIVISION

ALLIS-CHALMERS

MILWAUKEE · WISCONSIN

the ground, packless type. Additional load gages of different ranges, and grips of various types, are available to specifications. Over-all height is approximately 7 ft. Detroit Testing Machine Co., 5137 Trumbull Ave., Detroit.

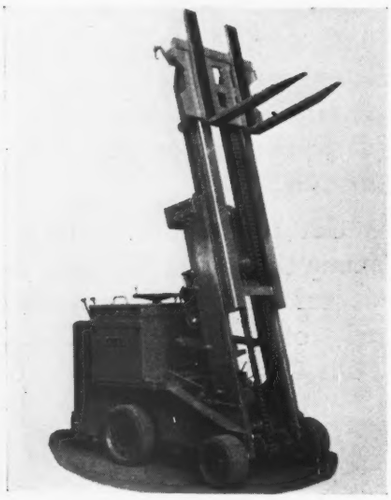


Recorders and Controllers

Line of pH recorders and controllers employ the glass electrode method of measurement, and are offered in wide strip-chart and round-chart models. Automatic controllers are offered in both electric and air-operated models, and can be plugged into any standard light circuit, fluctuations in the line voltage being automatically compensated for. Shielded-glass and calomel electrodes are used. Electrolytic connection between the internal assembly and the solution under measurement is maintained through a small hole protected by a ground glass sleeve. The inclosed-flow type (solution measured flows through the chamber) and the immersion type (for immersion in tanks and vats) can be used in viscous or semi-solid substances, and in rapidly circulating or flowing liquids. Automatic compensation for temperature changes is provided for. The Bristol Co., Waterbury, Conn.

Fork Truck

Type 3–ETF–106 fork truck, with or without tilting and telescoping features, is powered with a heavy-duty, double-reduction, spur-gear drive with one-piece axle. It has a welded frame, heavy leaf springs, and anti-friction bearings in drives and steering connections. The hoist carriage is mounted on roller-bearing rollers and operated with a roller chain. The tilting mechanism is of the non-jamming type with a crank motion that can operate in either direction. Battery box is removable as a complete unit. Four disk wheels have solid rubber tires. Traction brake and electric horn are other features. Capacity: 6,000 lb. maximum load permitting travel at 3¾ m.p.h. The Atlas Car & Mfg. Co., Cleveland.

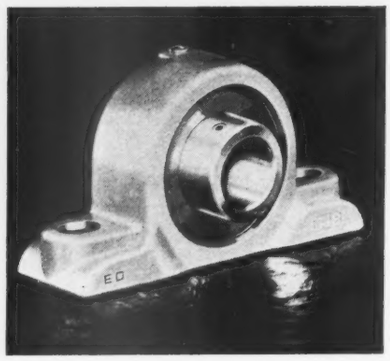


Structural Glass

"Glastone" structural glass, made by bonding an opaque, colored-glass facing with a light-weight concrete, is used in constructing glass-walled buildings to any height, and is available in a wide range of colors. The facing is bonded to the concrete block with a layer of mastic and anchored by a hidden rustproof, metal binder. It weighs 90–100 lb. per cu. ft. and comes in thicknesses of 4 and 8 inches. Surface areas or units range up to 12 sq. ft. It is installed like ordinary masonry, has a non-porous surface, and can be cleaned with soap and water. Its resistance to moisture is high; it also possesses considerable heat resistance. Libbey-Owens-Ford Glass Co., Toledo.

Ball-Bearing Pillow Blocks

Series ED ball-bearing pillow blocks for light machine applications, fans, packaging, labelling machines, consist of a single-row



bearing in a die-cast housing. The ball bearing is designed to provide for shaft deflection and misalignment up to 1 per cent. The seals, made of Neoprene, are of floating construction to eliminate friction and increase the life of the seals and bearing. Standard shaft sizes are ½, ⅝, ¾, $1\frac{5}{8}$, 1, 1⅛, and $1\frac{3}{8}$ inches. Ahlberg Bearing Co., East 29th St., Chicago.

Heavy-Duty Fans

Heavy-duty "Aerospot" fan unit, adapted to man-cooling service in large plants, has a frame of heavy welded steel tubing and a rolled angle-ring base. It is powered by an inclosed ball-bearing motor with adjustable motor supports, and is equipped with magnetic starter, pushbutton control, and cord with armored plug. The fan features forged aluminum-alloy blades. A mesh protection is provided on the sides, and the front and rear faces. Furnished in capacities from 3,000–26,500 cu.ft. per min. South Bend Air Products, Inc., South Bend, Ind.

Viscosity Meter

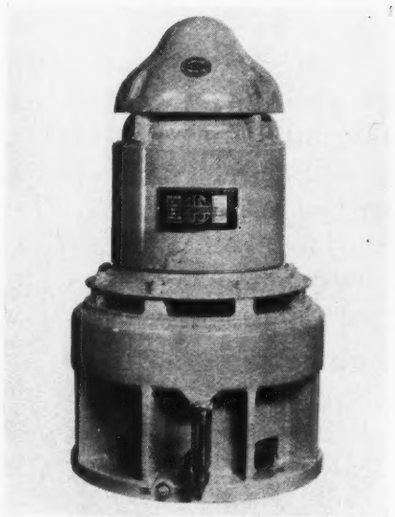
"Saybolt Viscosimeter," for determining oil viscosities, has automatic constant-temperature control said to be accurate to ±0.03 deg. F. It features a mercury thermostat for temperature control; double-walled, glass-insulated bath; 660-watt unit to bring the bath up to temperature, and two 60-watt auxiliary heaters to maintain temperature; quick-heat warning signal; cooling coil permitting low-temperature tests during hot weather; totally immersed induction motor stirrer for circulating the oil; and draft shield around rear and sides of bath to prevent disturbance of oil-thread. Main double-pole snap switch cuts off circuits when tests are completed. Controls are in a separate control box that is removable for remote mounting. Available in 2- and 4-unit models. Precision Scientific Co., 1750 North Springfield Ave., Chicago.

Lathes

The 14½-in. swing lathes, for use in tool room and machine shop, have attachments adapting them for fine tool and gage work, and other jobs. Made in quick-change-gear and standard-change-gear types, in motor drive and countershaft drive, in bed lengths of 5, 6, 7, 8, and 10 ft. with distance between centers of 24½, 36½, 48½, 60½, and 84½ inches. The former has a thread-cutting range of 4–224 screw threads per in.; the latter has a range of 4–160 screw threads per inch. The lathes have a swing-over saddle of 10¼ inches. Metric lead screw and metric graduations are available. Smooth, silent operation, ease of control, and accuracy are claimed. South Bend Lathe Works, 425 East Madison St., South Bend, Ind.

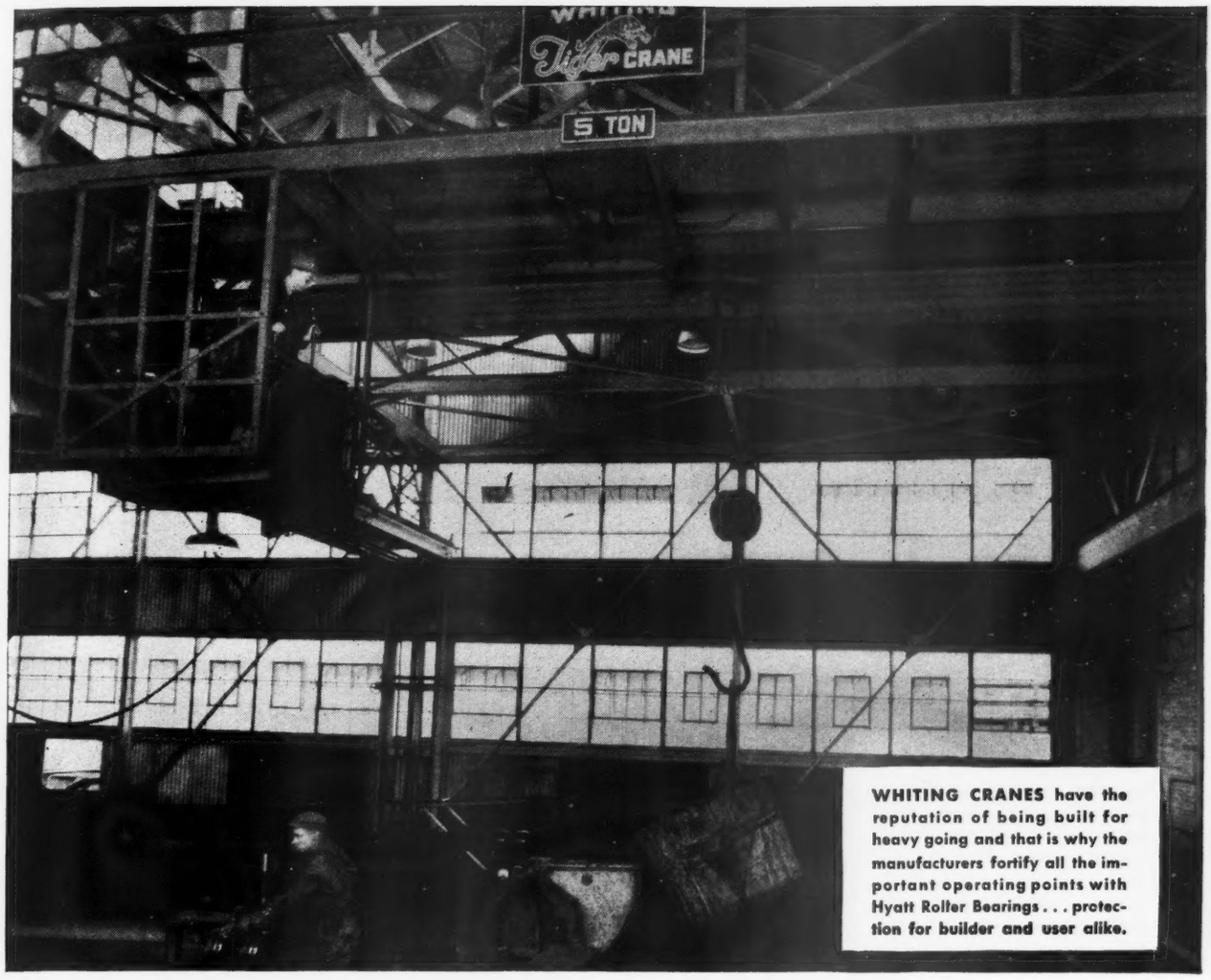
Tension Wrench

Automatic tension wrench permits presetting to the exact pressure required so that the wrench will release automatically when the desired pressure on the bolt is reached. Presetting facilitates tightening of bolts in dark or difficult places as one can feel as well as see the operation of the lever arm. There is no dial to watch. The socket end is small and approximately half the weight of the other end. Scale reads in inch-pounds. Sunnen Products Co., 7908 Manchester Ave., St. Louis.



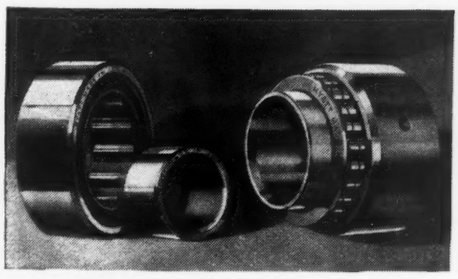
Vertical-Type Motor

Vertical "Syncrogear" motor, Type GDV, complete with flange base, incorporates a small geared oil pump which forces the oil supply to bearings, gears, and pinions.



WHITING CRANES have the reputation of being built for heavy going and that is why the manufacturers fortify all the important operating points with Hyatt Roller Bearings . . . protection for builder and user alike.

Where the Going is Heavy



GO HEAVY ON HYATTS

Built for heavy going, Hyatt Roller Bearings ask for no soft jobs. And not only do Hyatts help keep equipment in perfect running order while new, but continue to give uninterrupted performance for life of the equipment. Therefore, in considering bearing applications, here's something worth remembering for machine builder and user alike: to keep bearing wear and care out, always put Hyatts in! Hyatt Bearings Division, General Motors Sales Corporation, Harrison, New Jersey; Detroit, Chicago, Pittsburgh and San Francisco.

HYATT
ROLLER BEARINGS

Write your ticket

CHISHOLM-MOORE HOIST CORPORATION
TONAWANDA, N. Y.

RUSH! We are interested in dependable, low-cost hoisting. Send your illustrated booklet titled **"a few cents a day"** describing in detail the **new COMET Electric Hoist.**

YOUR NAME.....
COMPANY.....
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for cut-rate hoisting

★ **EASY TO INSTALL**
Just hang up and Plug in

★ **DEPENDABLE PERFORMANCE**
Precision built—Overload tested

★ **GREATER EFFICIENCY**
Less fatigue—More production

★ **LOW INITIAL COST**
500 pound capacity only $130.00

★ **ECONOMICAL OPERATION**
(Mail above coupon for details)

You can put brand new economy into your material handling—with speedy 1939 COMET Electric Hoists. Don't tire your workmen with lifting and carrying heavy loads. For production line or general handling—use COMET Hoists on trolleys, monorail or cranes to lift and transport loads overhead. Increase efficiency—save floor space—reduce those "hidden" costs. Capacities 250 to 1000 pounds.

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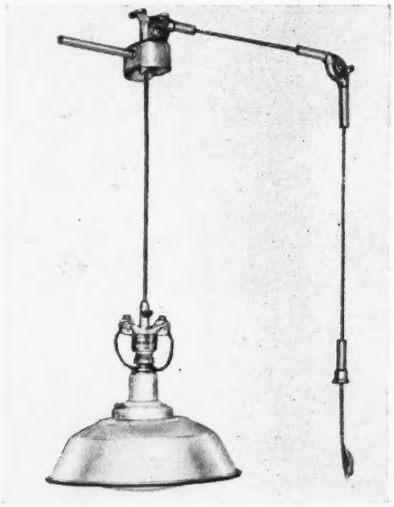
In Canada . . . McKinnon Columbus Chain, Ltd., St. Catharines, Ont.
In South Africa . . . McKinnon Chain (S. A.) Ltd., Vereeniging, S. A.

CM COMET

Consists of heat-treated, oil-lubricated, helical gears mounted on ball bearings inclosed in dust-tight housings. Available in sizes ¼ to 30 hp.; motor speeds, 900 to 1,800 r.p.m.; shaft speeds, 4,260 to 8.3 r.p.m. U. S. Electrical Motors Inc., 200 East Slauson Ave., Los Angeles.

Floodlight Hangers

Hangers that make possible disconnecting and lowering floodlights for cleaning and servicing, permit radial adjustment and locking of the floodlight so that when



the floodlight is returned after lowering, it will position itself. The hangers consist of U-bolts for mounting to the bracket, bracket and slipfit elbow to inclose electrical conductors, inclosed corner pulley with flare end, 25 ft. of galvanized chain, galvanized lock box. The chain is equipped with a link for anchoring in the lock box and a spring to keep the chain taut and prevent wind slap. Thompson Electric Co., Cleveland.

Filters

Self-cleaning, automatic filter 822, for removing dirt and solid particles from lubricating oils and liquids, is built so that as many as six filter units can be inserted to increase filtration capacity. A large sump is provided to permit long filtration cycles. Speed reducer permits filtering units to be turned at 6 r.p.m. with a 1,725-r.p.m. motor. Filter elements are available in various porosities, each having a cleaning mechanism of removable knife-edge segments. A thermometer mounted on the shell shows temperature of liquid inside filter. Operates with a ¾-hp., 3-phase, 60-cycle, 220- or 440-volt, a.c. motor—vertical, totally inclosed, general-purpose type.

Self-cleaning, automatic, coolant filter 823, for coolants and liquids, differs in construction and operation from 822 only in that its gear-reduction drive is located on top of filter cover instead of inside shell. S. F. Bowser & Co., Inc., Fort Wayne, Ind.

Sludge Pump

Portable air-operated sludge pump Type 7, working on the ejector principle, is ap-

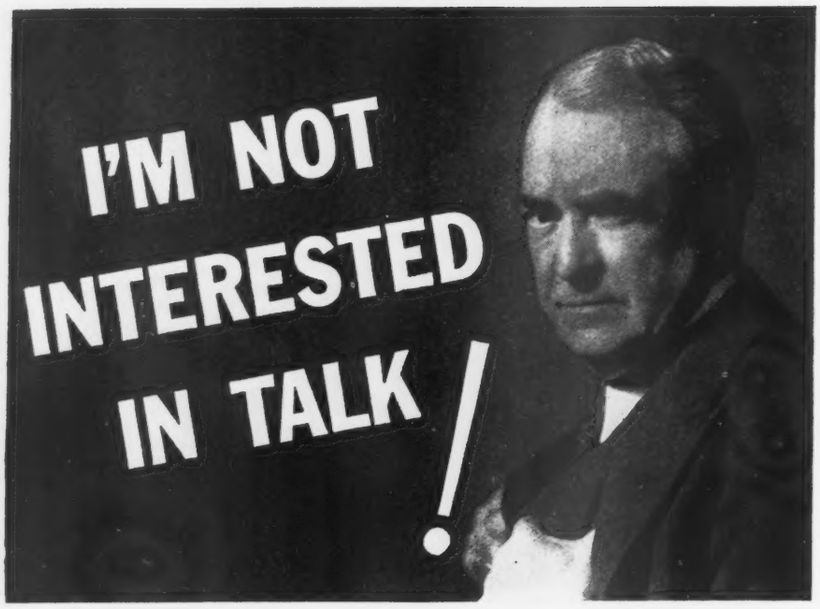
DISSTON DI-MOL HACK SAW BLADES are *Tough*

DISSTON U.S.A.
Di-Mol

...make men and machines more efficient...

Toughest hack saw blades are Disston Di-Mol, on special steels, modern alloys, castings. They stand up under trying feeds and speeds developed in machine sawing. Shop men can treat them rough. *And still you get more efficiency!* The Disston name, on orange band on blade, assures you of uniformity, quality, value. Standard teeth, lengths, widths, thicknesses. Hand blades, ½ gross in box. Machine blades, 1 dozen. Henry Disston & Sons, Inc., Philadelphia, U. S. A.

ASK YOUR DISTRIBUTOR OF DISSTON DI-MOL BLADES

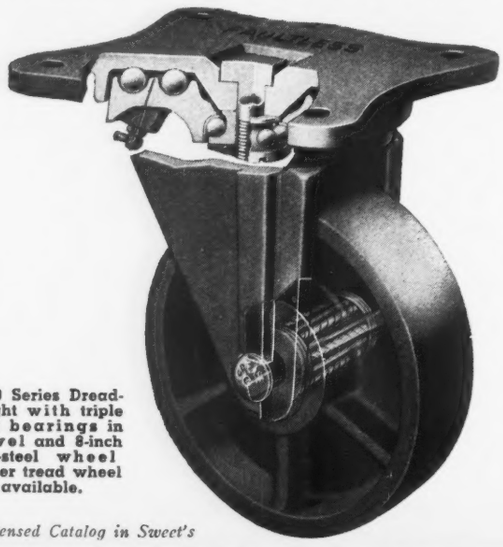


How good are they by actual test?

That's an everyday question, but it never stumps a Faultless salesman because he is armed with a collection of facts which show beyond question that Faultless Casters for industry are making a notable contribution to better factory transportation at a lower mileage cost.

For example, examine the Dreadnaught. Here is a semi-steel heavy duty caster to lick your breakdown troubles. Note the triple ball race—*3 rows* of hardened steel balls which distribute the weight carried over a wide surface—promoting easy swiveling. And no matter how heavy the load, *this* caster rolls freely because a Hyatt Roller Bearing is used in the wheel. Likewise, *every* Faultless Caster is distinguished by noteworthy features.

For further facts on the complete Faultless line, write for catalog or ask for a Faultless representative. There's not the slightest obligation.



1500 Series Dreadnaught with triple ball bearings in swivel and 8-inch semi-steel wheel Rubber tread wheel also available.

Condensed Catalog in Sweet's

FAULTLESS CASTER CORPORATION
Dept. FM-7
Evansville, Indiana
Branches in Principal Cities
Canadian Factory:
Stratford, Ont.

FAULTLESS CASTERS FOR INDUSTRY

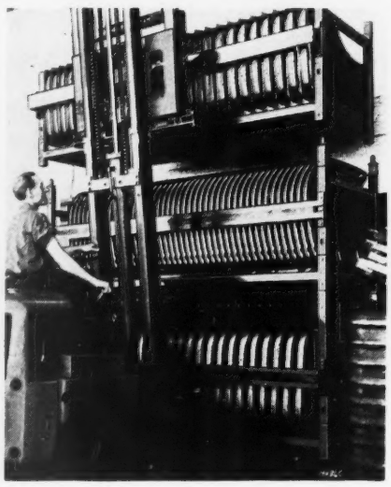
plicable in sumps, pits, construction jobs. High lift capacity, low air consumption are claimed. Ability to handle up to 15 per cent of solids, and to handle water containing sand or rock drill cuttings are other features. Capacities range from 20–65 gal. per min. depending on the head. Chicago Pneumatic Tool Co., 6 East 44th St., New York.

V-Belt

V-Belt, for use in the presence of oil, strong chemicals, heat, or a combination of them, is made of Neoprene. Adaptable to any V-drive, it is said to be quickly adjustable to length. The manufacturer calls it a 60-second belt because it can be uncoupled from the roll in less than a minute, it is claimed, and then made endless on any drive in less than a minute. Manheim Mfg. & Belting Co., Manheim, Pa.

Work Carriers

Standard unit of the arc-welded steel-tube work carrier has a load-carrying capacity up to 3,000 pounds. Made in standard dimensions, the carriers are flexible in combination and are for use in handling a



variety of materials. The basic unit consists of a frame measuring 3 ft. 3 in. by 9 ft., and a 2 ft. 8 in. upright frame at one end. A removable frame may be inserted at the other end. Frames of various lengths are available for inserting at either end to suit heights required by the material carried. Castors may be slipped under the end of each upright. for hauling the unit around singly or in "trains." Side rails and hold-down rails are attachable. Floors and sides of wood, or solid or perforated metal, are available to provide bins for small parts. Loaded, the carriers can be stacked in tiers. Dowel plugs slipped in the top of each upright secure the stacked tiers against slipping. Mechanical Handling Systems, Inc., 4700 Nancy Ave., Detroit.

Magnetic Clutch and Brake

Magnetic clutch and magnetic clutch-brake combination, adaptable for flywheel or through-shaft application on power presses, power shears, punch and stamping presses, die-casting machines, are designed to fit into a small area. Speed of operation can be timed to meet conditions. They can

This Ice and Storage Plant could not afford Shutdowns

THE New England Ice Company, at Providence, R. I., has a very fine plant. In addition to a big ice output, it operates a large fur-storage department with $1,500,000 to $2,000,000 worth of furs to protect—big stakes in anybody's game!

About every 5 days, the ammonia-compressor valves would plug with hard carbon residue from the oil in use. The compressors had to be stopped and the carbon scraped out. Time, money and temperature rises plagued Chief Engineer Ernest Rotelli.

That's all changed now. The Shell lubrication engineers were called in and recommended the proper grade of Shell Compressa Oil. The new lubricant formed so little carbon—and so soft a carbon—that hard-carbon difficulties disappeared.

That's not all the story at Providence. Their converted Diesels, on Shell Talpa Oil, show no excess carbon, no scoring. Oil consumption has decreased, and Engineer Rotelli reports excellent performance.

With this experience on lubrication, it is not surprising to find the New England Ice Company using "Shell Dieseline" to fuel its engines, making the plant 100% Shell serviced.

Shell engineers are thoroughly prepared to help wherever lubrication difficulty occurs. They are anxious to aid you no matter how slight your problem may be.

SHELL

SHELL INDUSTRIAL LUBRICANTS

DeVILBISS SPRAY FINISHING EQUIPMENT BRINGS YOU NEW PROFITS . . . NEW FIELDS TO EXPLORE IN MODERN PRODUCT FINISHING

In charting your course to more profitable product finishing—as in plying rough seas—let modern, dependable equipment and veteran experience be your guide. Rely on DeVilbiss Spray Finishing Equipment.

DeVilbiss' half century of spray engineering and manufacturing experience has been an invaluable aid in lowering industrial finishing costs. With years of experience in solving countless finishing problems, DeVilbiss has repeatedly uncovered new savings.

Count on DeVilbiss to supply modern equipment, correctly designed for dependable performance. There's DeVilbiss equipment for all finishing operations—for products of all sizes and shapes—for all finishing materials—for any production system.

Ask a DeVilbiss Spray Expert to help you improve product finishing quality and reduce costs . . . show you new, pro'itable uses for the spray process.

THE COMPLETE DeVILBISS LINE CONSISTS OF: Spray finishing equipment . . . Automatic coating machines . . . Tanks for spray materials . . . Spray booths and exhaust fans for vapor and dust elimination . . . Air regulators, cleaners and dusters . . . Air compressors . . . Respirators . . . Specialized hose for paint, air, water, gasoline, welding and pneumatic tools . . . Hose connections . . . Water and oil guns . . . Equipment to prevent offset in printing . . . Paint stripers . . . Medicinal atomizers . . . Perfume atomizers.

DeVILBISS SPRAY SYSTEMS

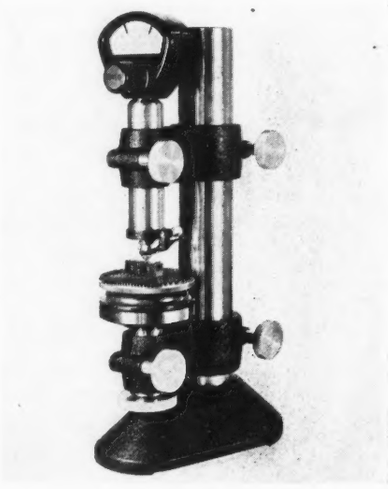
THE DeVILBISS COMPANY • TOLEDO, OHIO • U.S.A.

be installed in the field. Collector rings may be put on the hub or body of the clutch or clutch-brake combination. Available in a variety of combinations and sizes. Stearns Magnetic Mfg. Co., Milwaukee.

Rubber Bearing Cartridges

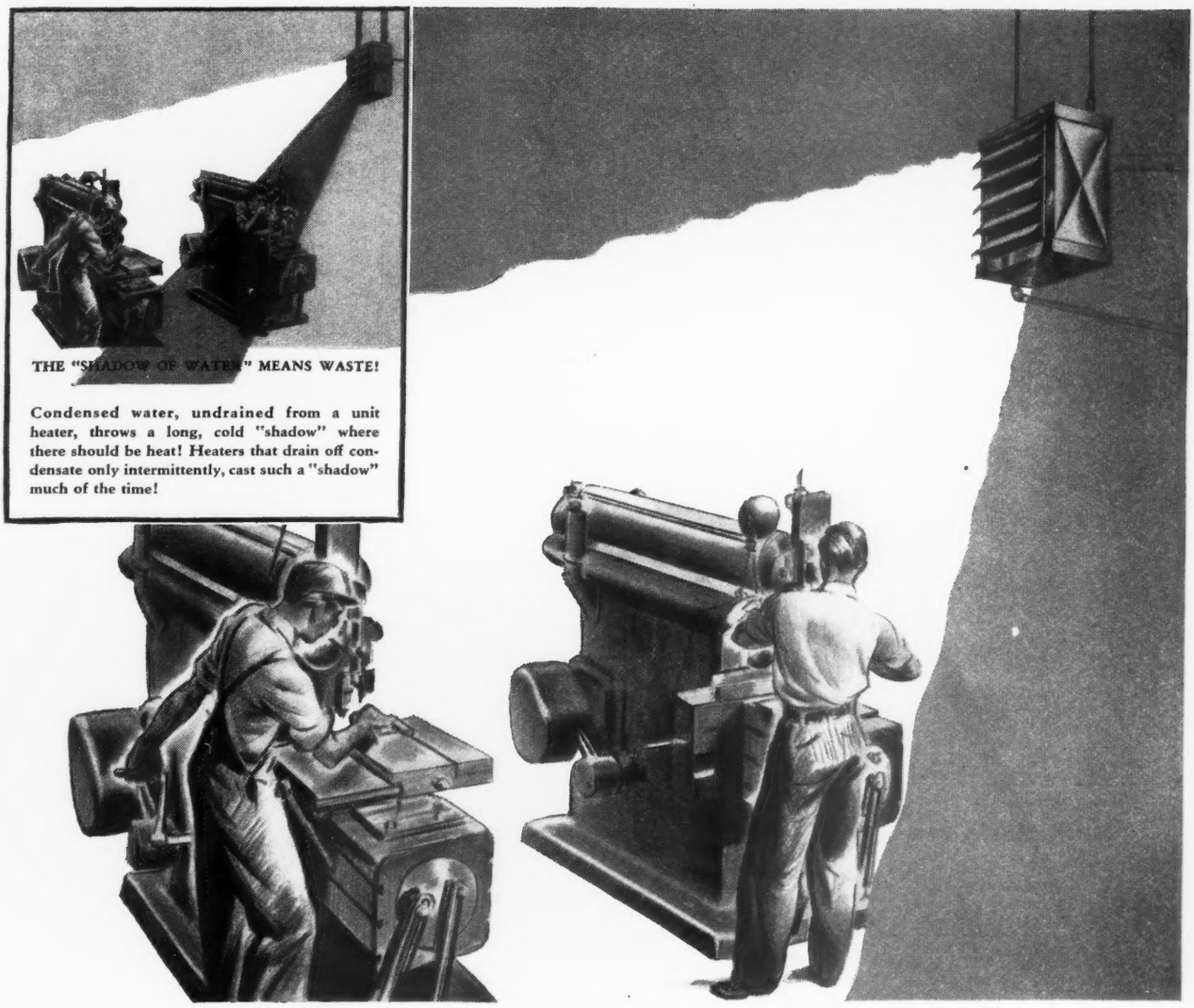
All-rubber bearing cartridges, available in flange and cylindrical cartridge units,

feature a resilient housing that insulates the bearing, absorbs noise and vibration, and automatically compensates for small errors of alignment and longitudinal shaft-expansion. Each type is constructed with a wide inner-ring ball bearing with self-locking collar, bored to inch dimensions, for slip fit on stock shafting. The cartridges can be installed without machining, locknuts, sleeves, or adapters. Primarily for use in the heating, ventilating, and air conditioning fields. Available in shaft diameters from ¾ to 1 7/16 inches. The Fafnir Bearing Co., New Britain, Conn.



Gage

"Mikrokator" portable measuring instrument employs the principle of frictionless amplification to attain accurate repeat readings. Amplifying mechanism consists of a metal strip twisted in a helix, one end of which is anchored to a rigid member, the other to a movable member. Spindle carrying measuring tip transmits its movement to this movable member causing a pull on the strip. This pull causes strip to untwist, moving pointer mounted in center of the



THE "SHADOW OF WATER" MEANS WASTE!

Condensed water, undrained from a unit heater, throws a long, cold "shadow" where there should be heat! Heaters that drain off condensate only intermittently, cast such a "shadow" much of the time!

NO *"COLD SHADOWS"* WITH THERMOLIER . . .

Only Thermolier offers you the exclusive Internal Cooling Leg that *continuously* drains condensed water . . . that keeps a full beam of shadowless heat pouring from all of the heating surface *all* of the time. Is it any wonder that Thermoliers deliver more heat for the money, resulting in lower fuel costs per season?

Grinnell's 50 years' heating experience has built *14* outstanding points of superiority in Thermoliers! Three types and thirty sizes means there's a Thermolier exactly fitted to your needs. Write today for the 48-page Thermolier Data Book and get full details. Grinnell Co., Inc., Executive Offices, Providence, R. I. Branch offices in principal cities.

THERMOLIER'S SHADOWLESS HEAT MEANS FUEL SAVINGS LIKE THESE

A well-known plant reports savings of 29% in steam consumption since modernizing with Thermoliers.

A railway and dock shop, after replacing with Thermoliers, uses 75 tons of coal less per season — a saving of 35%.

In just one plant of fifty operated by one of the country's largest manufacturers, savings with Thermolier are $50 per day!

GRINNELL THERMOLIER

THE UNIT HEATER WITH 14 POINTS OF SUPERIORITY

GOSH-THIS COUGH HAS GOT ME, BILL!

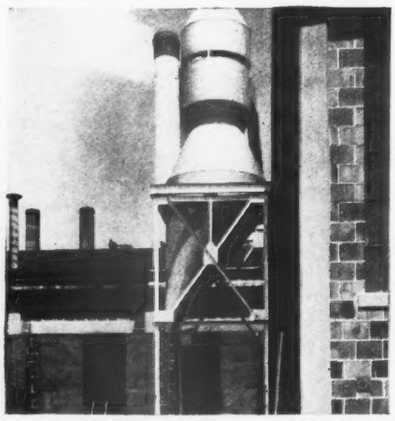
"Yeah, Jack, the dust in your department is terrible! I know, I used to work there."

UNCONTROLLED dust or fumes from industrial operations present a serious health menace. They endanger the health of workers, cut-down efficiency, and often create costly cleaning and maintenance problems.

Rid your plant of this hazard by taking advantage of modern Sturtevant Dust or Fume Removal Equipment.

Sturtevant Dust and Fume Removal Systems are expertly designed—are based on over 75 years of air engineering experience. They provide not only thoroughly effective removal of dust and fumes—but also assure the advantages of low power consumption and space economy.

We would welcome your inquiry.



Sturtevant Dust and Refuse Collecting System for carpenter shop.

Sturtevant Fume Removal System for carrying off fumes from plating and other baths.

B. F. STURTEVANT COMPANY
Hyde Park, BOSTON, MASS. *Branches in 40 Cities*
B. F. Sturtevant Company of Canada, Ltd.
Galt, Toronto, Montreal

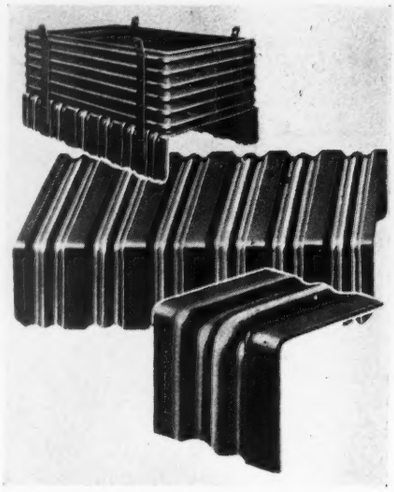
Sturtevant
REG. U. S. PAT. OFF.
Puts Air to Work

FOR DUST AND FUME REMOVAL

strip. The amplifying mechanism is under constant tension so as to insure transmission of the slightest movement of the measuring tip to the dial pointer. Parts subject to wear have been eliminated. Measurements can be taken on the upward or the downward movements of the spindle. Scales are graduated to 0.0001, 0.00005, and 0.00002 in. Scale divisions can be read to half a scale division. Swedish Gage Company of America, 7310 Woodward Ave., Detroit.

Lift-Truck Platforms

All-steel lift-truck platforms with double corrugations come in the customary varia-



tions, including a complete line of steel corrugated platform boxes. The platform corrugation consists of two half-round recesses joined by a raised center rib. The platform is in one piece. Corrugations are continuous, going up one side, over the platform, down the other side. This construction, it is claimed, gives the sides, knees, and platform, additional strength. The Union Metal Mfg. Co., Canton, Ohio.

Variable-Speed Transmissions

Briggs & Stratton Corp., Milwaukee, are now the exclusive licensees for the manufacture and sale of the Graham variable-speed transmission, now to be called the "Briggs & Stratton Variable Speed Transmission."

Extension Spray Gun

Model 23 "Thor" spray gun allows the operator to apply paint directly to surfaces usually out of reach. It is used in work on interior walls, ceilings, truss work, girders. Made of alloy metal, it is light in weight. A knurled screw behind the nozzle head controls width of spray. Available in 3-, 4-, 5-, 6-, and 7-ft. lengths. Binks Mfg. Co., 3114 Carroll Ave., Chicago.

Spray Nozzles

"Whirljet Simplex" hollow-cone type, non-clogging spray nozzles are for use in air conditioning, roof cooling, and in chemical processes. They are one-piece and made of brass, although other metals may be speci-

HE SILENCED JUNIOR'S DRUM—
But He Can't Escape the Clatter at Work

Noise Upsets Workers—Cuts Their Production . . . Blasts Your Profits

What a terrible-tempered Mr. Bang a man can be when noise destroys the peace at home! But often there's an excuse. With men who work where deafening noise makes life a nightmare it's only a natural reaction.

How your workers react to noise at home isn't your problem. But their unconscious reaction to noise in the factory is! It saps their energy, destroys their efficiency. May cut their production by as much as 30%!

Reduce Noise—Increase Production

Reduce the noise level in your plant and fight this waste! Rubber can help—in an inexpensive way. Just have those clanking steel wheels on inside trucks and trailers replaced with silent Goodrich Vulc-On Rubber-Tired Wheels.

With quiet Goodrich rubber cushioning loads, the noise level drops — the production level jumps. Your men will do more work in less time. Do better work, too!

You Save $ $ $ Every Way

Goodrich Rubber-Tired Wheels don't crunch or splinter floors. They keep materials rolling faster to speed up plant operation. They conserve power. Reduce damage to loads. Retard depreciation of equipment. Cut maintenance costs.

And you get these important benefits for years and years, because Goodrich Vulc-On Wheels are built to last. Their sturdy one-piece construction eliminates bolts and nuts. The metal doesn't rust or corrode. The rubber tires are permanently vulcanized to the rim. Anti-friction roller bearings assure smooth operation.

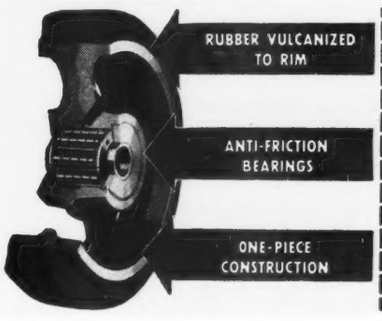
Get the Proof Now

A Goodrich engineer will survey your equipment, recommend the correct Goodrich wheels, estimate costs. He will even figure in dollars and cents the savings you can expect from a change-over.

Act now! A phone call to your local Goodrich dealer or Goodrich Silvertown Store starts things moving. Or, you can send us the coupon just below. There's no obligation!

Goodrich *Industrial* Tires

THIS GOODRICH VULC-ON WHEEL *Pays its own way!*



Dept. N-61

The B. F. Goodrich Co.
Akron, Ohio

Gentlemen: Please mail me (without obligation) your booklet on Goodrich Industrial Tires and information on how they pay for themselves.

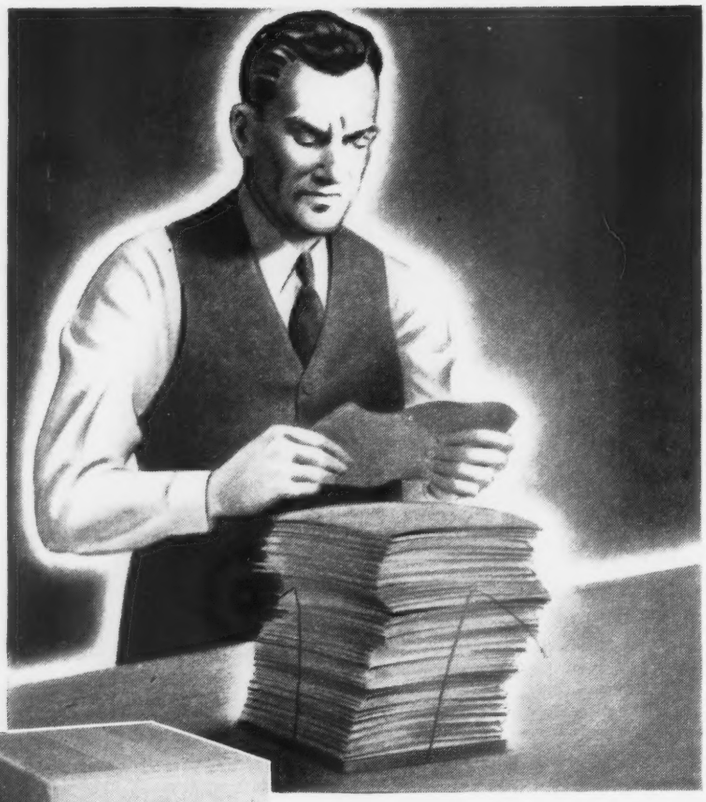
Name _____

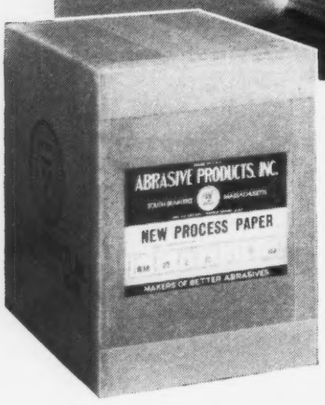
Company _____

Street _____

City and State _____

We Put An End To "CRACKER-BARREL" Handling..To Bring You FACTORY-FRESH Abrasive Papers





ONLY A. P. OFFERS ALL THESE ADVANTAGES:

"MASTERPAK" Containers • 48-Hour Action On ALL Orders • Authoritative Technical Counsel • Complete Line–Over 2000 Items.

With "Masterpak" — an exclusive AP Package — we take your distributor out of "cracker-barrel" abrasive business. And guarantee to *you* that your order will arrive promptly . . . factory-fresh, crisp and ready for use . . . untouched by moisture, dirt or rough handling.

Another feature of AP's service program is 48-hour ACTION on all special orders (just 24 hours for *regular* items). Our flexible production schedule is *designed* to be broken — so that *yours* need not be . . . The advantages listed at the left are just a few of the reasons why thousands of users are finding it's profitable to specify "AP" for all abrasive needs — from a ream of standard sandpaper to a built-to-order belt. Abrasive Products, Inc., 513 Pearl St., South Braintree, Mass.

ABRASIVE PRODUCTS INC.
JEWELOX • JEWEL EMERY • JEWEL GARNET • JEWELITE • JEWEL FLINT • NEW PROCESS

fied. Available in ⅛-, ¼-, and ⅜-in. male pipe connections; capacities range from 0.1 to 2.5 gal. per min. at 10 lb. pressure. Spraying Systems Co., 4922 West Grand Ave., Chicago.

Diverting Relay

Type R048A diverting relay is air-operated and finds application in pneumatic control work, in changing over a control system between its summer and winter control cycles. It is not snap acting, requiring a change of 0-15 lb. pressure to actuate it. May be used to divert source of air into either of two outlets, to feed air to a branch line in one position, stop the main line and bleed the branch line in the other position, and to shut off an air line without bleeding the branch line. Minneapolis-Honeywell Regulator Co., 2950 Fourth Ave. South, Minneapolis.

Coupling

"Controlled Torque Steelflex Coupling" is said to be able to slip under instantaneous high peak loads ranging 500–1,000 per cent of the normal torques, and thus protect mechanical drive systems against damage caused by shock overloads. Through adjustable control, any peak load demand beyond the desired work range is eliminated by setting the load to meet requirements. The coupling is designed to damp out shocks, reduce vibration, provide for accidental parallel and angular shaft misalignment, and to allow free end float. It consists of a hub, two half covers, a grid member, and a grooved ring. The adjustable-pressure clutch consists of an inner and an outer hub which are kept concentric by oilless bushings. The Falk Corp., Milwaukee.

Rotating Shelving

Sectionalized rotating shelving, for general use in toolrooms and stockrooms for

parts and tool storage, consists of rotating trays with sectional center stems. The trays are set one above another on the stem. Each unit can be located singly or in groups for machine service at strategic spots on the production floor, or can be

COMPRESSORS RUN A FULL SEASON NOW, WITHOUT OIL SLUDGING

● ONCE STARTED on the season's run, this Iowa Ice Plant has no time for shutdowns. That's why the plant engineer praised Stanoil so highly after he first tried it.

A number of oils had been used in air and ammonia compressors in the plant. At the end of each season there was a messy, time-consuming job of cleaning sludge from crankcase and bearing wells, and removing carbon deposits from pistons, rings and valves. But worse than this, in one instance stoppage of an oil line, attributed to sludge, caused a serious bearing failure, and there was the constant threat of other shutdowns.

But now, with Stanoil on the job, the engineer says, "Even after a full season of continuous operation, there is little or no carbon to be removed, and absolutely no sludge or deposits. And, best of all, we don't worry about shutdowns the way we used to."

Stanoil is giving this same clean operation on many types of equipment. Reduction gears, ring oiled bearings, oil circulating and hydraulic systems are a few applications. Let a Standard Lubrication Engineer tell you about the other qualities of this oil.

Copr. 1939, Standard Oil Co. (Ind.)

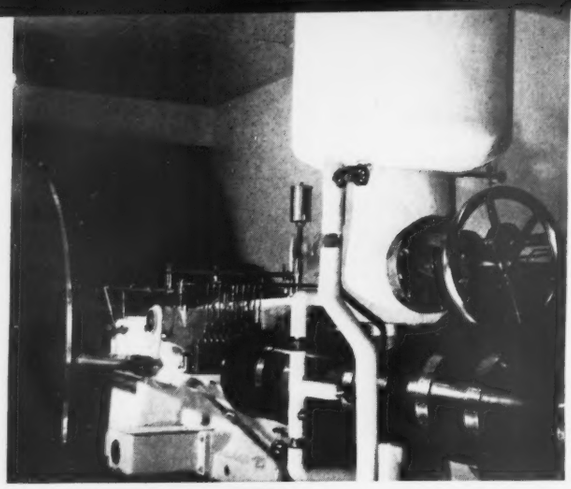
STANOIL

FIRST IN SERVICE
FOR FIFTY YEARS
STANDARD OIL (IND.)

STANDARD OIL COMPANY
(INDIANA)

LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICA

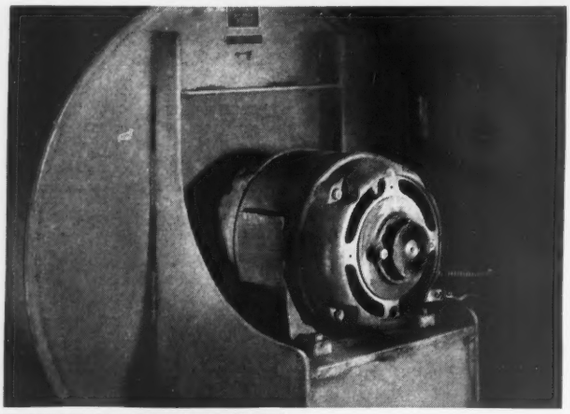
...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION ENGINEE



STANOCYL

When oil consumption was reduced from 1 gallon to 3 pints per day on his Skinner Uniflow engine the plant engineer thought that StanoCyl was about the best steam cylinder oil he had ever used. But he had the surprise of his life when he found that StanoCyl cost no more per gallon that the oil he had been using.

This saving was no surprise to the Standard Lubrication Engineer who recommended StanoCyl. A 50% reduction in oil consumption is *not* unusual. In addition StanoCyl invariably gives adequate lubrication of valves and cylinders, even with this lower consumption. That's another saving you make . . . reduced maintenance costs with StanoCyl.



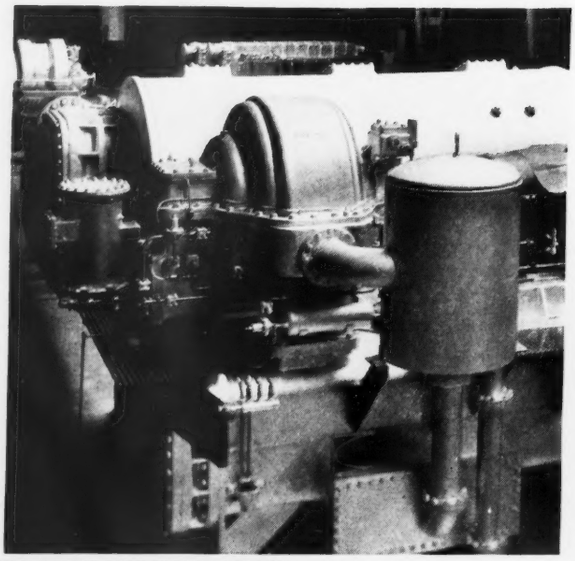
SUPERLA GREASE

Make this test of Superla Grease on some of the grease packed motor bearings in your plant! Put Superla in one end bearing. Pack the brand you now use in the other end. See if you don't get the same results that a central state manufacturer did when he recently completed this test.

For the test he picked motors ranging from ¼ HP to 25 HP in both vertical and horizontal types. Now, after two years, the Superla-greased bearings have never been touched. The others have been repacked time and again.

Let a Standard Lubrication Engineer specify the right grades of Superla for the jobs you pick. If you want him to, he will be glad to help you make the test.

YOU CAN GET THE SAME SERVICE THAT MADE MONEY FOR THESE MEN...



STANOIL

Three years of highly satisfactory service from a midwestern Carrier Air Conditioning plant has also meant an excellent three-year record for lubrication with Stanoil.

For instance, the original fill of Stanoil in the Terry speed-increasing gear is still in use after three years. A recent examination of the oil shows it to be in excellent condition.

Motors ranging from ½ HP to 60 HP on fans, pumps, etc., totaling 1050 HP are all lubricated with Stanoil, as well as the 650-ton-capacity centrifugal compressor . . . a good illustration of how this one oil, Stanoil, can handle a wide variety of lubricating jobs and do each one better.

DO YOU WANT HELP ON A LUBRICATING PROBLEM?

Have you a bearing that runs hot . . . a conveyor that takes too much power . . . oil sludging in gear cases or compressors? These are but a few typical problems recently solved by Standard Lubrication Engineers.

Your lubricating trouble may be different, but the results will be the same when a Standard Lubrication Engineer has helped locate the cause. Bearing failures stop . . . power costs drop . . . maintenance and oil costs get back in line. What's more, this helpful service will cost you nothing.

If your plant is located in the 13 states shown above send the coupon or call your local Standard Oil (Indiana) office. Just ask to have the Standard Lubrication Engineer see you.

STANDARD OIL COMPANY (Indiana), JULY
910 S. Michigan Avenue, Chicago, Illinois. Room 1217

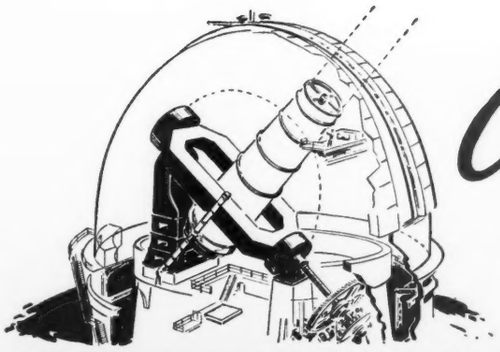
Please have the Standard Lubrication Engineer in my locality call on me.

Name .....

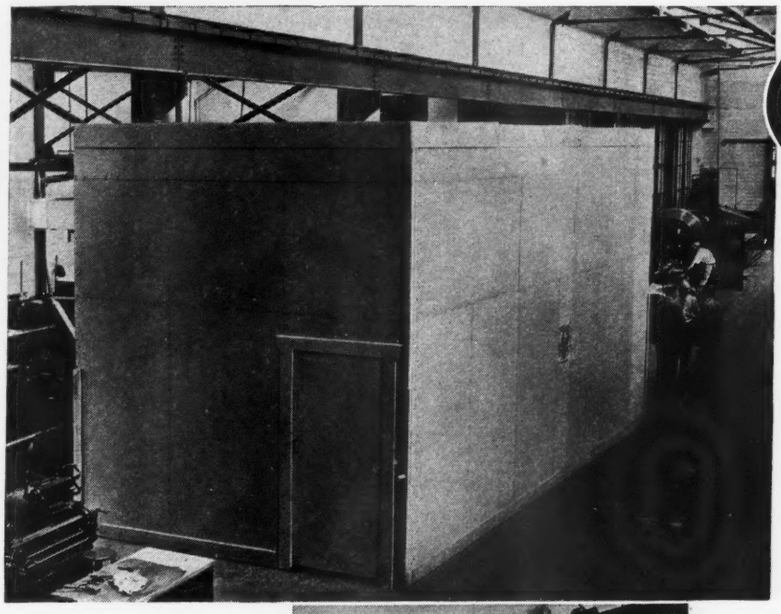
Company .....

Address .....

City ..... *State* .....
(One of the 13 states shown on the map)



Controls Temperature within ½ degree

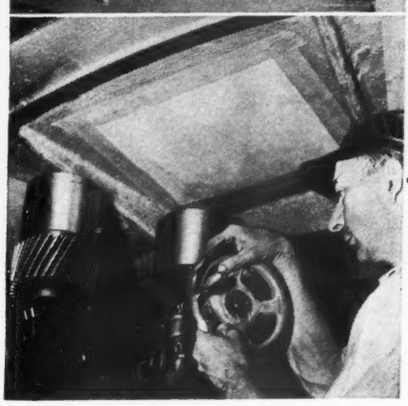


Carrier
Air Conditioning

Success of World's Largest Telescope Depends on Controlled Temperature During Grinding of 9-Ton Gears

SUCCESS OR FAILURE of world's largest telescope for famed Mount Palomar Observatory depends on Carrier Air Conditioning—720 teeth of delicate focusing gears are cut in a constant temperature of 75° F. maintained by Carrier in this "house within a house." Special air conditioned "bungalow" is built within giant machine shop of California Institute of Technology where gears for "glass eye" are being made.

LESS THAN ½° CHANGE in temperature, day and night, was found in "bungalow" after tests to prove Carrier Air Conditioning could control temperature within 2°! This faultless accuracy is necessary to guard against expansion and contraction of gear teeth when cutter bites into the metal. Without Carrier controlled temperature, there is danger of temperature changes during process. Any variation in teeth size would affect delicate calculations of scientists.



0.0004 OF AN INCH is extent of variation allowed between gear teeth. Close-up view of gear clamped between dies shows gear before cutting. Carrier Air Conditioning fills exacting need of engineers for controlled temperature during every part of grinding operation. For instance, running water used to carry away heat from the gear cutting tool is kept within 1/10° variation by Carrier!

For Telescopes or Products—It's Carrier!

● **Your needs for controlled temperature may not be as unusual as the construction of the famous Mount Palomar "glass eye." But it is just as important to you and to your products to control temperature accurately for manufacturing, processing or for storage in your plant.**

Carrier Air Conditioning meets the exacting needs of scientists, engineers and factory superintendents in every industry. Wherever production can be improved or speeded by controlled temperature, there is Carrier equipment to meet the demand. Carrier centrifugal compressors, dehumidifiers, cold diffusers, heat diffusers, individual units and other types of Carrier equipment meet your specifications for top results at low cost.

Carrier Igloo of Tomorrow

New York World's Fair

Whatever your production problem, call your local Carrier representative. He is willing and glad to help you without the slightest obligation. See him today—it pays!

CARRIER CORPORATION, Syracuse, N. Y., Desk G8
"Weather Makers to the World"
In Canada—Box 1050, Station C, Toronto.

Without obligation, send me Carrier's Industrial Catalog and information about Carrier Air Conditioning for industrial plants.

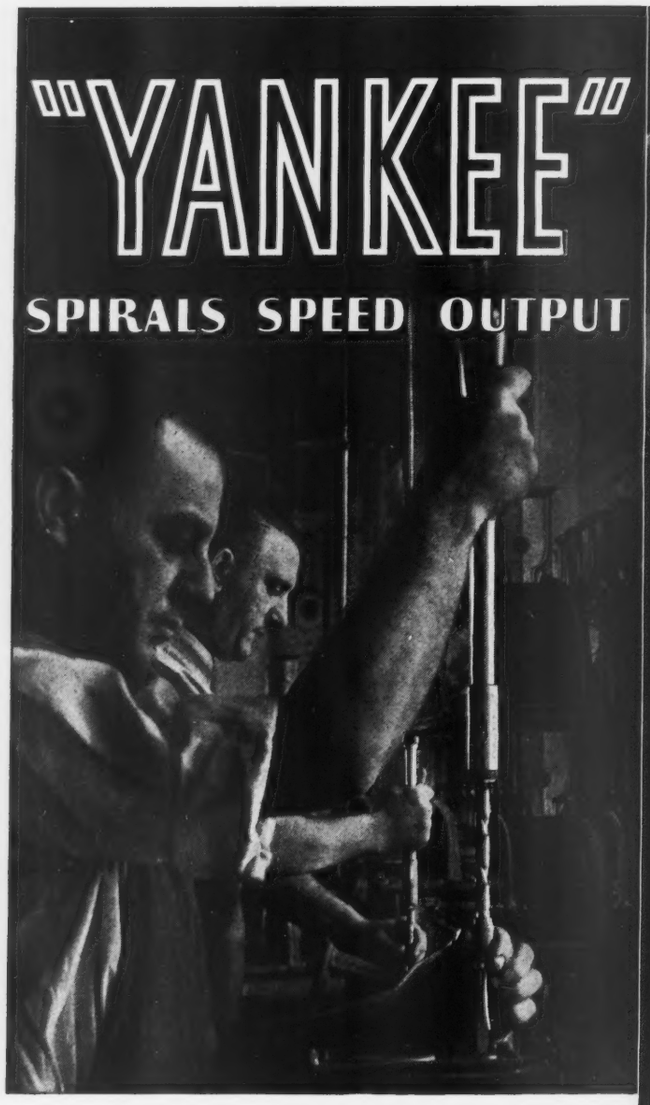
Name.....

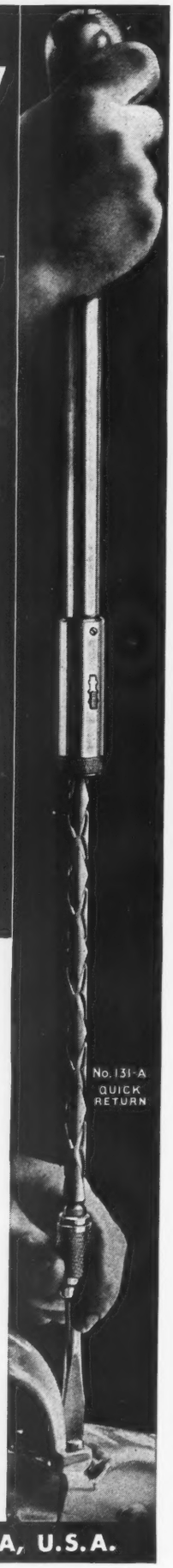
Company.....

Address.....

"YANKEE"

SPIRALS SPEED OUTPUT





■ Spring in handle of "Yankee" Quick-Return Driver keeps bit in screw. Right and left ratchet adjustments, and rigid. Standard, Heavy, Light patterns. With or without spring in handle. Available in various sizes—lengths (extended) with bit, from 27½" to 12⅜". Three different size tested "Yankee" bits with each driver. "Yankee" Tools save time and labor.

ORDER "YANKEE" SPIRALS, VISES, DRILLS, ETC., FROM YOUR JOBBER

For "YANKEE" Tool Book, write North Bros. Mfg. Co., Dept. F, Philadelphia, U.S.A.

NORTH BROS. MFG. CO., PHILADELPHIA, U.S.A.

(Continued from page 116)

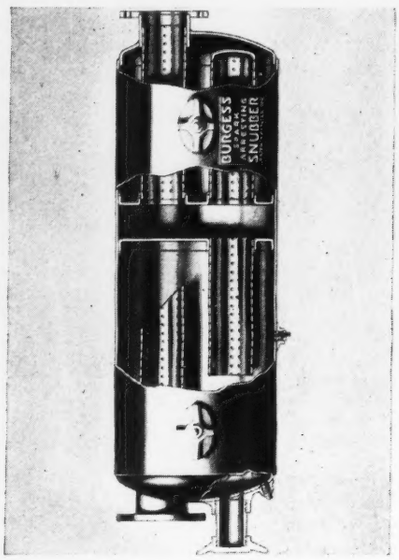
set up for assembly-line and work-bench use. Use of the "Ro-Tray" system, it is claimed, cuts aisle space down by one-third, and reduces waste in machine-time and man-hours. Ro-Tray Corp., National Press Bldg., Washington, D. C.

Fluorescent Desk Lamp

Fluorescent "daylight" desk lamp has a fixed reflector designed to give the greatest amount of light with the least glare possible. The Alzak section is set in to direct the larger portion of the light at the long angle, while the white pigment diffuses the stray light. A 15-watt, 18-in. fluorescent lamp is used. The reflector is 6¾ in. wide and 18¼ in. long; base is 11×6 inches. The lamp is supplied with thermal reactor for 60-cycle, 110-, and 120-volt, a.c. circuits. When specified, it can be used with a magnetic reactor for a.c., or with a thermal reactor and resistor for d.c. operation. The Miller Co., Meriden, Conn.

Exhaust Muffler

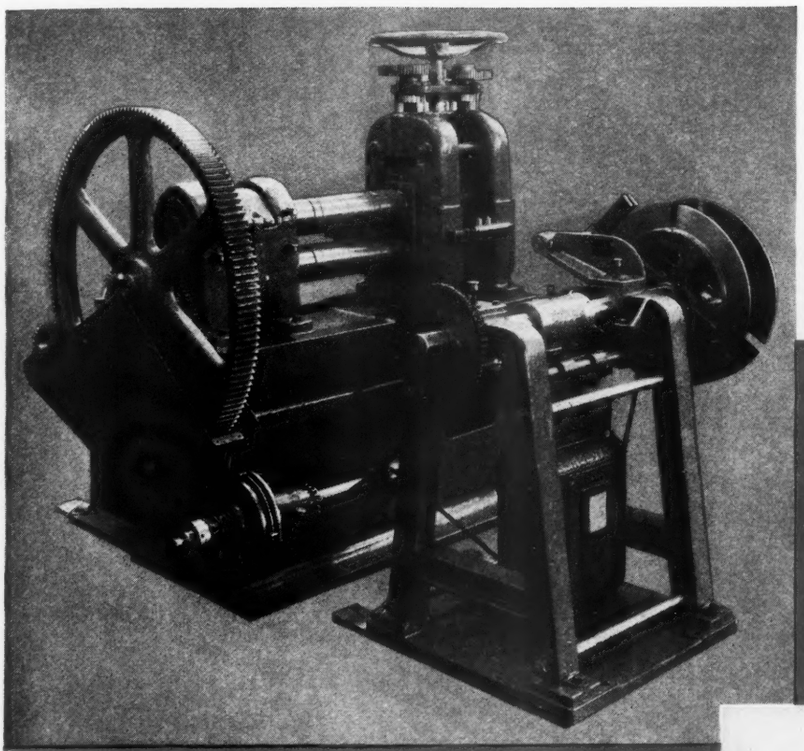
To trap flying sparks from the exhaust of diesel engines, and to prevent exhaust noise, the SDHS Snubber catches the slugs of high-velocity exhaust gas which rush



into the exhaust pipe and bleeds them to low pressure. The carbon and ash particles drop into a chamber in the bottom of the snubber. The snubber operates with any kind of engine. It can be installed anywhere in the exhaust pipe system, but it must be installed vertically. Available in 19 standard sizes with connections ranging from 2–30 in. in diameter—flanged to match standard 125-lb. American pipe flanges. Shells and heads are welded of heavy gage steel. Burgess Battery Co., Acoustic Div., Dept. NR, 500 West Huron St., Chicago.

Electric Valve

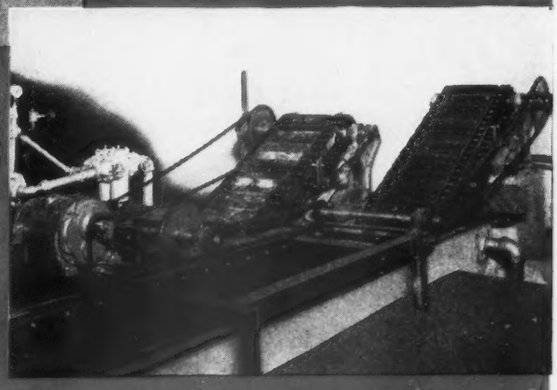
Self-contained electric control valve, for throttling of gas, oil, or air flow to furnaces, ovens and like applications, combines valve and valve operator in one unit. Operation is on the electro-thermal expansion principle;



Weak Link Strengthened—Smart maintenance men use Baldwin Steel Replacement Chain for loaders, pilers, etc. All roller chain advantages—and fits existing sprockets.

Feeds: Fast but Fixed—Want to control machine operation? Take a tip from the Baldwin Roller Chain on this wire flattening machine.

Boon to Brains—Baldwin Chain helps smart production men put their ideas to work—as at the delivery end of this continuous heating furnace. →



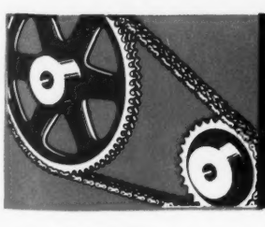
BALDWIN USES *are Universal*

Biggest feature of Baldwin Roller Chain today is its range of usefulness. *Speed?* — Inches or less to 4000 feet per minute. *Horse power?* — Small fractions to 1000 H. P. *Where can you use it?* — Everywhere.

Machine builders select Baldwin Roller Chain when they want sustained positive action and long life. Maintenance men can benefit from their experience. The new Baldwin Catalog — it's really a handbook — will suggest hundreds of profitable uses for roller chain. Baldwin Engineers will help apply them in your plant — if you wish their help, call the B–D man. Baldwin–Duckworth Chain Corporation, Springfield, Mass. Factories at Springfield and Worcester, Mass.

GAS BUGGY OF 1892

When C. E. Duryea built America's first automobile, he chose Baldwin-Duckworth Roller Chain to drive it. It's a choice today to drive heavy modern trucks—result of a 47-year record of doing its job well.



BALDWIN-DUCKWORTH

A FIRE SENTENCED TO DIE

In 3 Seconds!

Here's a sure-handed, dependable weapon against fire. It kills blazes with the fastest known extinguishing agent —carbon dioxide snow-and-gas. It spells sudden death to fire! It harms nothing but fire.

LUX extinguishers and LUX Built-In Systems are *engineered for industry*. LUX protects vital processes, costly and delicate equipment. Old-fashioned extinguishing methods are not good enough for industry. Industry wants the speed, precision and safety of LUX equipment.

Electrical and flammable liquid fires—industry's worst hazards—are no problem in a LUX-equipped plant. Send the coupon. Get the facts now.

Announcing Kidde-LUX

Easy one-handed operation and trigger action make this new Kidde-LUX Model Two a sensational success against smaller fires. Aim it . . . pull the trigger . . . LUX snow-and-gas smothers the blaze. No pumping to disturb your aim. *Just fire at the fire!* Send the coupon for information on this newest fire-fighter, priced at $10.85.

LUX SNUFFS OUT FIRE

Walter Kidde & Company
712 West Street, Bloomfield, N. J.

Send me "Instant Death To Fire". I understand it describes the new Kidde-LUX as well as other LUX extinguishers.

Name .....

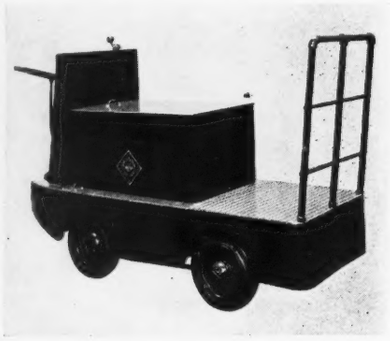
Company .....

Address .....

hunting is minimized; and mechanical movement is confined to expansion and contraction of the inclosed-operating cylinder. Proportional throttling, screw adjustment for minimum flow, rheostat adjustment for maximum flow, are other features. Furnished for 110 or 220 volts, a.c. or d.c., with transformer and rheostat, in a variety of sizes. Wheelco Instruments Co., 1929–33 South Halsted St., Chicago.

Truck-Tractor

Type IE small industrial truck-tractor, with rated capacity of 3,000 lb., has four



speeds forward and four reverse. Drive unit employs free-coasting worm and gear and is equipped with a 500 per cent-overload motor. The frame is made of heavy plates welded into one piece, including control dash and pedal guard. Detachable end gate on platform permits adjustment for additional load. Provision is made for pulling trailers. Safety features are pedal guard for protection of operator's legs, dynamic brake supplementing the travel brake, elimination of fuses in the power circuit. The Elwell-Parker Electric Co., Cleveland.

Furnace Window

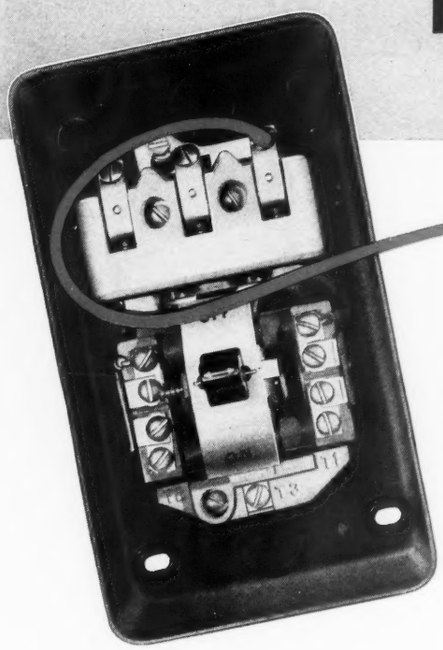
"Fire Observer," permits observation of the interior of the furnace, fuel bed, furnace walls, and boiler tubes, through a pyrex-glass-covered port. The pyrex port remains closed and thus keeps out cold air. The port is covered on the inside with a shutter which raises to permit a view of the interior. The pyrex glass is colored to diffuse the glare of the fire, and it is protected from the flames by a monel metal screen. The port measures 6×4½ inches. Detroit Stoker Co., General Motors Bldg., Detroit.

Pump

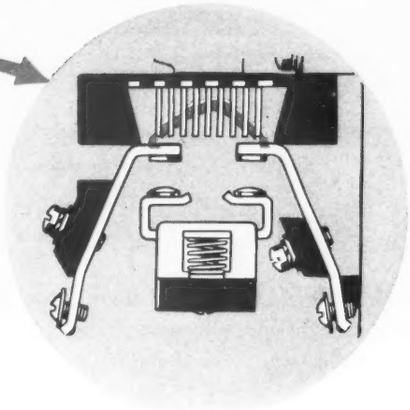
"Rota-Radial" pump, for elevator applications, is a 7-cylinder unit. The cylinders

"De-ion" Arc Quenchers

PROLONG CONTACT LIFE IN THIS NEW MANUAL STARTER



When the switch is opened, arcs are quenched instantly by "De-ion" grids. Note how the arc is drawn into the grids, cut into small pieces and extinguished.



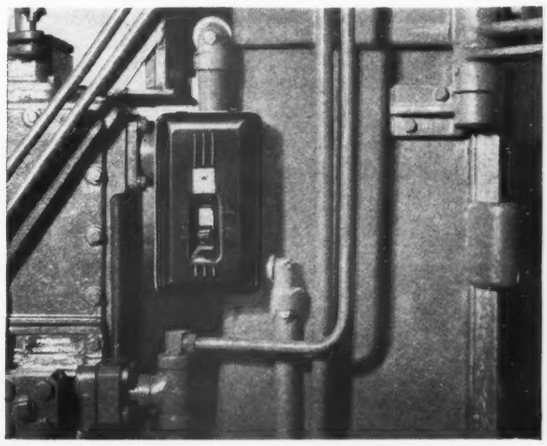
Snuffs out arcs . . . prevents flashover . . . stops burning of contact points. It's 1939's best buy for starting motors up to 7½ hp.

COMPARE with any starter at the price

- snap action bi-metal disc relay cuts the motor from the line before heat from overload can damage the windings. Resets to correct calibration.
- equipped with safety interlock — prevents accidental contact with live parts.
- indicating handle shows at a glance whether starter is on, off or tripped.

Phone your nearest Westinghouse office or distributor for prices, sizes, types and capacities.

J-20849



WESTINGHOUSE ELECTRIC & MANUFACTURING CO., East Pittsburgh, Pa.

Westinghouse

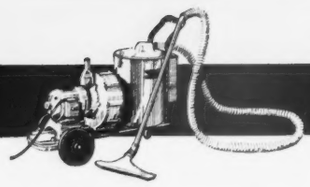
"De-ion" Motor Watchman

WESTINGHOUSE ELECTRIC

DO YOU WANT—

1 A MUCH CLEANER PLANT..?
2 LOWER CLEANING COSTS..?
3 FREEDOM FROM DUST-DAMAGE?

Then look what INVINCIBLE INDUSTRIAL VACUUM CLEANERS *will do*



First of all, they ***really clean*** because dust and dirt is **removed,** not scattered around to resettle and damage equipment, machinery and product. The plant is virtually dust-free.

Invincibles clean all types of floors, from rough concrete to highly finished wood, and will handle practically any kind of dirt and litter except in the presence of water or oil.

Crowded, close quarters are no handicap to Invincible Vacuum Cleaners. Far from it. Invincibles clean wherever brooms can be used and a lot of places where brooms cannot reach.

Overhead cleaning of pipes, beams, walls, etc., become easy operations with Invincibles. Incidentally, with Invincibles on the job, these parts of the plant ***stay clean*** much longer.

Invincibles are invaluable for cleaning bins, shelving, motors, machinery, boiler tops, workbenches, conveyor belts, etc. If desired they may be used as efficient blowers.

Invincibles substantially decrease cleaning costs. One Invincible Operator often does the work of ***three men*** with brushes and brooms and saves an average of $2000 per year in payroll.

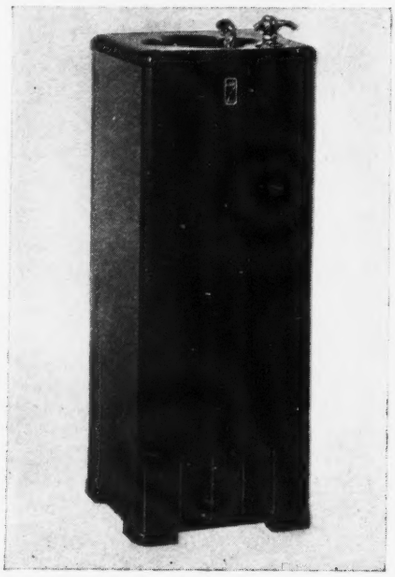
Last but not least, Invincibles seem virtually indestructible. Thousands of them have passed their twentieth year of continuous service. Before you say, "Vacuum cleaning is not practical for our plant," *talk to Invincible*.

INVINCIBLE VACUUM CLEANER MFG. CO. ... 440 DAVIS · DOVER, OHIO

are arranged in a circle as in an airplane engine—the pistons operating from an eccentric. It is designed for working pressures several times greater than that required for elevator use, and is said to facilitate operation of the elevators so that they get approximately 40 per cent more power or speed with a given motor. Quiet operation, little slipping, the tendency to start and stop smoothly with empty or loaded elevators, are other features claimed. Rotary Lift Co., Memphis, Tenn.

Water Coolers

Electric water coolers, built in bottle and bubbler types, occupy only 15½ sq. in. of floor space because of the doubledeck design of the self-contained condensing unit



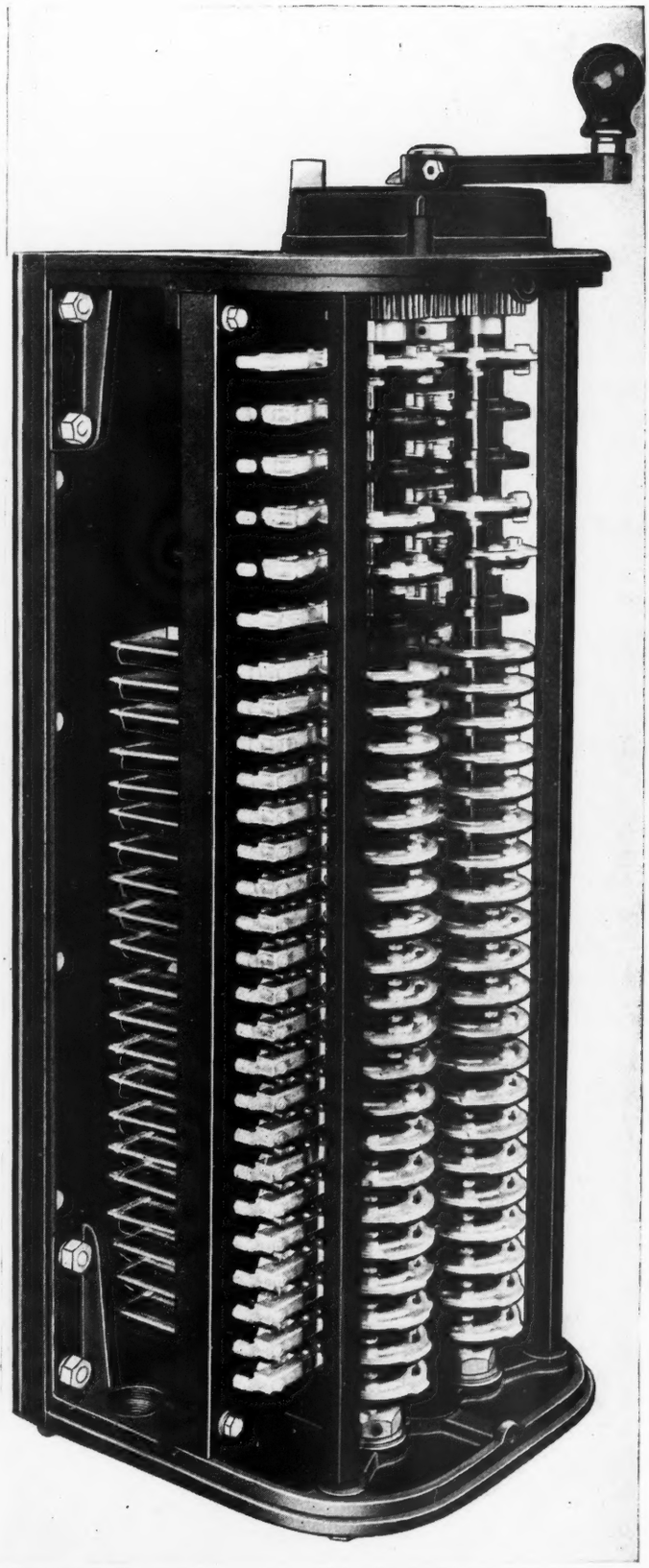
with compressor mounted above motor. Automatic control maintains water at preset temperature. To absorb vibration and make for quiet running, the refrigeration mechanism is set on rubber pillows. Available in five models: two models supply bottled-water service (standard cup-dispensing machines are provided); two bubbler-type models permit drinking direct from the stream, or the use of a glass; one model is furnished with restaurant-type pushback glass filler instead of bubbler. Large-capacity bubbler-type models are equipped to use cold waste water in pre-cooling incoming water. Inlet and outlet connections are 30 in. above floor for convenience in making connections to inlet and waste pipes. Cordley & Hayes, 145 Hudson St., New York.

Group Shower

Group showers with treadle control turn on automatically when users stand on the treadle platform, stop when thep step off. Water is pretempered to eliminate water waste during temperature adjustment. Available in circular and semi-circular, 5- and 3-person models, with or without partitions. Bradley Washfountain Co., Milwaukee.

Magnets

Hand magnet may be used for holding small castings for surface-grinding operations, for handling small articles, nuts, bolts, washers, and bin stock. Aids in cleaning



INTRODUCING...

The latest addition to the "3C" line of electrical control apparatus

SPECIAL BULLETIN 101 NON-REVERSING RUBBER MILL DUAL VOLTAGE GRAND MASTER CONTROLLER

¶ It operates manual reversing magnetic control equipment for two 125 HP, 115/230 Volt, DC, Rubber Calender Motors, and provides for operating these motors in tandem over the 2/1 speed range on either voltage.

¶ It provides 21 speed control points on either voltage by field control.

¶ It employs Cam operated contacts, for both control circuits and field points, and uses unit Type Grid Resistors for field resistance.

¶ Contact finger assemblies are interchangeable with Bulletin 101 Type R D Heavy Duty Mill Master Switch, Bulletin 101 Type F R Foot Switch, Bulletin 102 Type C L Cam Limit Switch, and Bulletin 102 Type H L Hatchway Limit Switch.

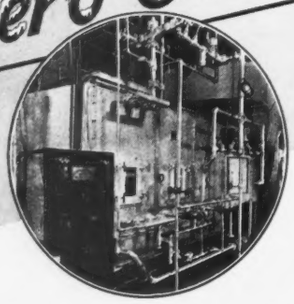
¶ Your inquiries for Rubber Mill Control and for other Process Industry applications will receive prompt attention.

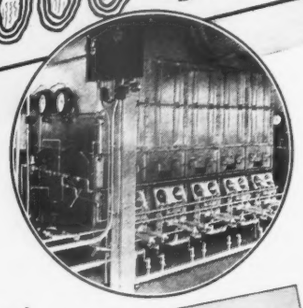
OFFICES IN PRINCIPAL CITIES

THE CLARK CONTROLLER CO.

1146 EAST 152ND ST. CLEVELAND, OHIO

Zero Cold or 1000° Heat





the air can be supplied with

ROSS

Air Systems

BAKING
DRYING
CHILLING
REFRIGERATION
AIR CONDITIONING
DEHUMIDIFICATION

Hundreds of exacting processing operations are not only being successfully completed with ROSS pure air systems, —but with far greater uniformity of production. They are designed for maintaining any temperature—from Zero to 1000°F. If it's a job for AIR—it's a job for ROSS Air Systems. What's your problem?

J. O. ROSS ENGINEERING CORPORATION

350 MADISON AVE., NEW YORK, N. Y.

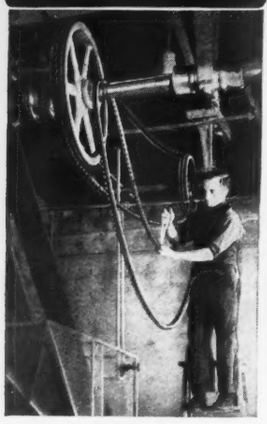
CHICAGO, ILL. DETROIT, MICH. PITTSBURGH, PA. PORTLAND, ORE.

ROSS ENGINEERING OF CANADA, LTD., Dominion Square Building, Montreal

JUST UNCOUPLE ANY LENGTH YOU NEED OF VEELOS V-BELT —

VEELOS *The 60-Second* **V-BELT**

— AND COUPLE IT ENDLESS ON ANY LINE SHAFT OR MACHINERY DRIVE WITHOUT DISMANTLING EQUIPMENT



ADJUSTABLE to any length. Uncouple from roll in less than 60 seconds. Then couple, *endless*, around any drive in 60 seconds. No costly teardowns of machinery or shafting.

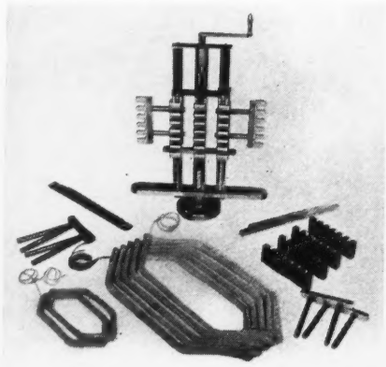
ADAPTABLE to multiple drives. Proper tension maintained on each strand for the life of the drive by removing standard link. Adjustability of links to uniform tension on each strand prevents costly slippage and shut-downs for replacement.

FLEXIBLE for long life. Users report 50% to 150% longer life than conventional type V-Belts.

● *Good distributors, coast to coast, stock Veelos V-Belting for your convenience. Write for name of nearest distributor.*

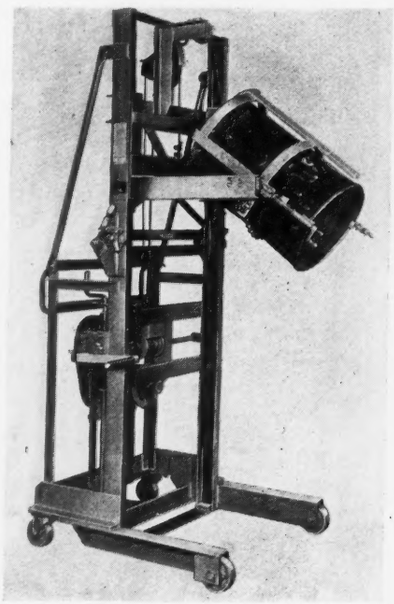
MANHEIM MANUFACTURING & BELTING CO., MANHEIM, PA.

and purifying small batches of filings and chips. Stearns Magnetic Mfg. Co., Milwaukee.



Coil Winder and Spreader

Combination coil-winding head and spreader provides an adjustable and collapsible form adaptable to operation by hand or by motor drive. It is said to be able to handle 85 per cent of all round copper coils, or gang of coils; to eliminate coil forms; to wind single or gang coils with absolute uniformity; to automatically provide a knuckle or nose on coil ends; to eliminate further hand or machine pulling. With three calibrated adjustments, the winder-spreader is ready for making a coil or gang of coils. General Electrical Specialty Co., 184-01 Hillside Ave., Hollis, L. I., N. Y.



Barrel Elevator

Portable barrel- and drum-elevating and emptying device has been designed to handle round wood, metal, and fiber containers in a wide range of sizes. The container, fastened to the elevating arms by a mechanical clamp, can be lifted to any practical height and tilted so as to empty into hoppers, processing equipment, or trucks. The container clamps and tilting device can be adapted to present electrically or hand-operated Barrett elevators of any capacity or height. Barrett-Cravens Co., 3255 West 30th St., Chicago.

SHAFER CONCAVE ROLLER—CONVEX RACEWAY

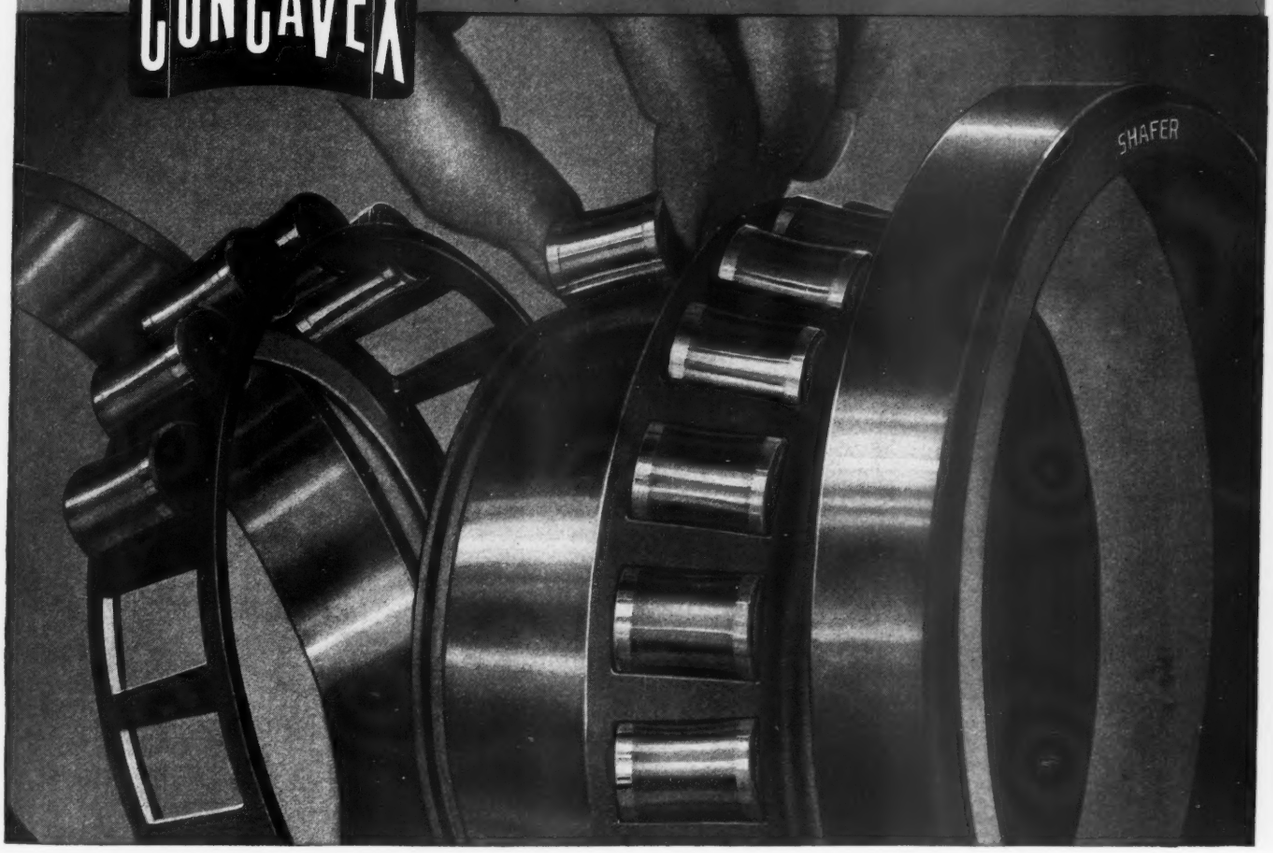
design provides thrust capacity as an integral function of the simple, compact basic design. Radial or thrust loads alone, or combined loads in any proportion, are provided for without the need for additional features. Shafer self-alignment maintains free rolling action and load capacity unchanged by shaft deflection, shock, or misalignment.

Available in a full range of sizes: Pillow Blocks · Welded Steel Pillow Blocks · Flange Units · Take-up Units · Hanger Boxes · Cartridge Units · Flange-Cartridge Units · Duplex Units · Conveyor Rolls · Radial-thrust Roller Bearings

SHAFER BEARING CORPORATION
35 EAST WACKER DRIVE • CHICAGO

Trademark reg. U. S. Pat. Off.

CONCAVEX



SHAFER *Self-Aligning* ROLLER BEARINGS

48 Weeks at 40-Hour Pay

(Continued from page 41)

steady stream of applicants looking for stenographic jobs—most of them new graduates of the business colleges. We sift out of this stream as we need them a few girls who are willing to work in the plant and bide their time for an office job, and we endeavor to give them enough days of office work scattered through the year to permit their retaining their speed and accuracy.

So, when you see a girl typing or taking dictation or running an accounting machine in our offices, she may be the same girl you noticed yesterday in a neat uniform working on the tea bag line. Very possibly, after the office rush is over and if we are still overstocked on tea bags, you may see her again tomorrow running the mustard filling machine or working in the production office.

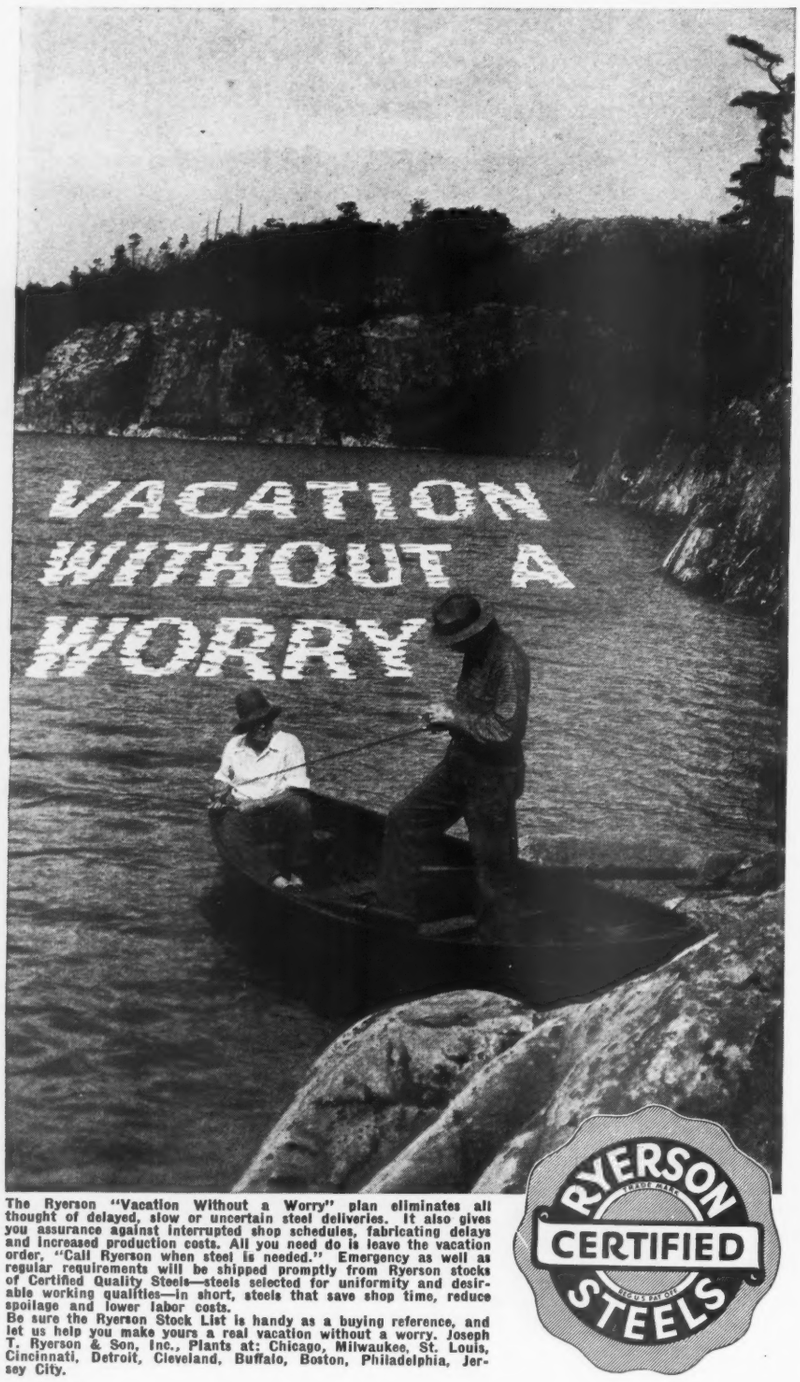
Last autumn business fell off in a few products, leaving us with more plant employees than we required. There already were operating in some promising areas small crews of salesmen selling our agricultural and garden sprays and insecticides for late winter and spring delivery—what might be called missionary salesmen getting orders from users as a help to show dealers the possibilities. Our personnel people and sales management already knew that there were some alert, ambitious young fellows in the plant—some of them fresh out of college—with the desire and the apparent qualifications for sales work. So enough of these men were hand picked from the factory to relieve the oversupply of workers. The remaining factory people were transferred as necessary to put the production organization in balance. The insecticide crews were enlarged, that promotion program was broadened, the young factory workers went out into the sales field.

Some few of them did not get the hang of it, had to be returned to Baltimore to their plant work. But the bulk of these men did satisfactory selling because we hire college men with a bent for selling and fill them into unimportant jobs until they mature. A few displayed outstanding ability, and are now apprentice salesmen of our general line, selling to dealers. The rest are, as this is written, back at the plant manufacturing the material that they sold last winter. Some of them will get sales jobs rather soon. Some have been cured of ever wanting sales jobs. But, from the standpoint of employment stabilization, here is one more minor crisis that has been surmounted without having to lay anybody off—a result that satisfies everyone.

Cooperation Essential

The fact is, almost anybody—if he has the proper spirit—can do an assortment of work, if he is given the opportunity. Of course our method would not be feasible in a business where the employees are organized in narrowly defined grooves and where strict regulations may prohibit transfers. Nor would it work where the management is too sot in its way to take the trouble to develop such a plan. But if management and men cooperate in a wholehearted desire to keep everybody working, it is astonishing how smoothly the thing gets to working eventually. After all, the serious menace today is instability of work, is it not?

You do not need a very complex set of records to make the plan work in any individual instance. When one of our truck drivers has no load to haul, and at the same time the assembly and packing department line is shorthanded, it takes about half a minute to locate a superintendent or foreman who knows



The Ryerson "Vacation Without a Worry" plan eliminates all thought of delayed, slow or uncertain steel deliveries. It also gives you assurance against interrupted shop schedules, fabricating delays and increased production costs. All you need do is leave the vacation order, "Call Ryerson when steel is needed." Emergency as well as regular requirements will be shipped promptly from Ryerson stocks of Certified Quality Steels—steels selected for uniformity and desirable working qualities—in short, steels that save shop time, reduce spoilage and lower labor costs.
Be sure the Ryerson Stock List is handy as a buying reference, and let us help you make yours a real vacation without a worry. Joseph T. Ryerson & Son, Inc., Plants at: Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City.

DON'T BUY *oversize* TRUCKS TO HANDLE *undersize* LOADS

Since—

Elwell-Parker builds each principal Model in a full range of sizes: big capacity Trucks for big jobs; intermediate sizes for medium loads; small Trucks for light loads. Up-to-date operating features: approved high standards of Elwell-Parker Engineering, Design, and Application.

New Elwell-Parker Center Drive Truck. Gives improved performance, better vision, greater safety for the operator

YOUR whole purpose in improving present methods of handling your materials is to reduce your costs of production and warehousing—to:

1—**Save More Money** by reducing your manufacturing costs—knocking out wasteful, obsolete methods of moving and transporting materials and goods.

2—**Save More Money** by releasing new funds for dividends or for capital improvement.

3—**Save More Money** by establishing *yours* as the low-cost plant in your industry with important *selling advantages* over competitors.

Elwell-Parker *proves by 33 years' experience* that "Materials Handling" is no loose phrase—but the description of time-tried methods for creating profits by correctly applying Elwell-Parker Power Industrial Trucks, Tractors and Cranes.

An efficient, low-cost materials-handling System made to your "measure" by Elwell-Parker will *earn* to the maximum because—Elwell-Parker builds the greatest number of Trucks, Tractors and Cranes; the greatest variety of sizes of each; the greatest number of attachments.

Long-experienced Elwell-Parker Engineers help you select the right model and size; specify (for unusual loads) the right *standardized* attachment—give you at reasonable total cost, the System that will do your work best and create the greatest savings *continuously.*

Find how an Elwell-Parker System will save in *your* plant. Elwell-Parker Engineers will bring the most interesting evidence. Send for them—by WIRE COLLECT.

The Elwell-Parker Electric Co., 4323 St. Clair Ave., Cleveland, Ohio.

ELWELL-PARKER *Power Industrial* TRUCKS

ESTABLISHED 1893 • BUILDING POWER INDUSTRIAL TRUCKS SINCE 1906

just where to put the driver to work. And five minutes later he is in a factory uniform helping out on the assembly and packing department line.

If there is no other job available, we can always turn him over to the maintenance boss, who has paint, brushes, and a waiting wall somewhere around. Bill may not sling paint with the same skill that he tools his big truck through waterfront traffic, but his painting will be adequate to our unexacting tastes in certain warehouse section of our plant, and he will be a lot better employed that way than laid off, either with or without pay. We are keeping up our plant, and keeping up the spirit and morale of our employees.

Looking for New Products

There are openings scattered through the organzation—not many, but enough to absorb the handful of people who might otherwise be sent home through no fault of their own. And, of course, we keep working on the problem of finding products that will fill in our valleys or help to level off our peaks.

Our plan has not yet reached the stage of perfection where it can function automatically. It still requires a little ingenuity from the personnel director and the supervisors of various operating departments, applied every once in a while when an emergency arises. But the fact remains that we have managed to keep all our people working full time, at full pay, and earning their way, even during the so-called recession, which we felt along with every one else. So, just possibly, there may be something about our plan that some other concern can use.

"Dag" colloidal graphite retains its lubricating properties in the presence of extremely high temperatures — it reduces wear, carbon and flake-off.

Ideal lubricants for equipment which operates at temperatures above the burning point of petroleum oil are prepared by dispersing "dag" in suitable fluids. These should be volatile at the temperatures in question. With the quick evaporation of the carrier fluid, a dry lubricating film of pure "dag" is left which physically combines with the bearing surface.

"Dag" colloidal graphite is chemically inert, non-gumming, odorless and non-oxidizing—it is economical and offers an ideal solution to high temperature lubrication problems in glass making and ceramic machines, for conveyors and baking ovens, for projectors, die casting and permanent mold equipment, etc.

A note on your letterhead will bring you an inspection sample and Bulletin 130 which tells how to use "dag" for high temperature lubrication. . . *You or your oil supplier can easily add "dag" to your present lube or to specially selected petroleum fluids.*

ACHESON COLLOIDS CORPORATION
PORT HURON, MICHIGAN

dag COLLOIDAL PRODUCTS

Management's Job— As I See It

(Continued from page 39)

of economics is to remain in this country, we owe fair consideration in ethics and in common sense to the individuals who put their money at risk for the sake of providing industry with its physical plant. The men and women on the payrolls cannot expect—and when they understand the whole truth, they do not desire—to undermine the stability of their employment by depriving their employers of the means to keep giving them more and better tools with which to perform their jobs and increase their wages and salaries. The customers cannot sensibly wish prices so low that the supplier must eventually fall down in his quality and service. Least of all does the general public profit by taking away from the thrifty savers all incentive to improve the service that their industries perform for society.

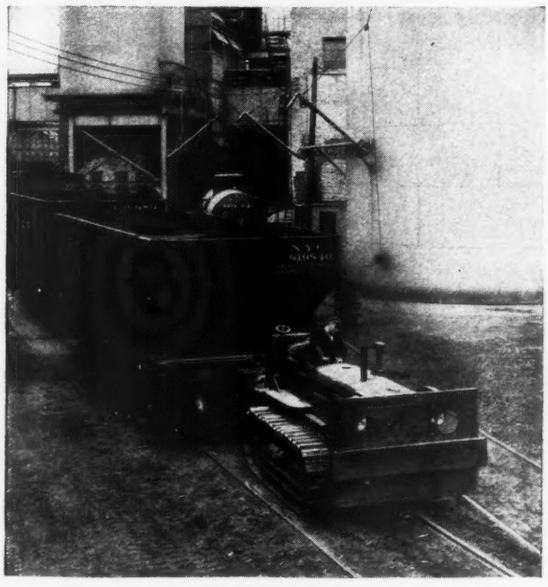
So, considered in the strictly logical order or urgency, it is essential that management aim toward profits and recognize its responsibility to give the stockholders a fair yield on the money they have scraped together for investment in ownership of the company. This is the foundation upon which sound industry must rest. Without it, the never-ending improvement of American industry will come at last to its end—and with it the American system of freedom in government.

Next in order of urgency is a decent working relationship with the human beings who are required for successfully running the business, whether they actually operate machines, sell the product, or sit at desks and coordinate the whole. Our company has recognized this obligation from its very start, has contributed its best intention and ingenuity toward giving employment at fair wages in pleasant surroundings.

Unquestionably, what we have ac-

CUTTING CORNERS ON COSTS

The International I-14 Industrial Tractor working in a Michigan plant. This handy, compact unit—smallest of the wheel-type tractors in the line—provides economical power for a wide variety of factory hauling.



This International T-40 TracTracTor, equipped with rear-end coupling and front bumper, is used by a plant in Chicago for switching and spotting cars within the factory yard. Distances cars are moved range from 15 to 500 feet. This unit is on the job night and day.

ECONOMY of International Industrial Tractors is proved in the rapidly growing demand for them by men who have had experience with a variety of tractor power. The examples shown here are only two of the diversified applications of these tractors. The call for International's economy, efficiency, and dependability increases every day.

International Tractors are available in wheel and crawler types. There are five wheel tractors (gasoline and Diesel), and six TracTracTors (gasoline and Diesel), including the new 70 h.p. TD-18 Diesel TracTracTor. The line also includes 11 different models of power units (gasoline, gas, and Diesel) ranging up to 110 max. h.p. In this wide variety, you will find the right tractor to fit your jobs. See the nearby International industrial power dealer or Company-owned branch for detailed information.

INTERNATIONAL HARVESTER COMPANY
(Incorporated)
180 North Michigan Avenue Chicago, Illinois

INTERNATIONAL Industrial Power

complished has come through the spirit thus engendered in our entire human organization, from bottom to top. The roller produces a measurably better product when he understands why his best licks are necessary, and when his work and his wages are such that he whole-heartedly wishes to give full value, plus something extra, for every day on the job. The research man is distinctly more eager to reach a successful result in his experiments when he likes the folks he is working with and feels a sense of participation with everyone else in the big task of his company. The executive officer brings a keener enthusiasm for the company's interests when he knows not only that he himself is adequately taken care of, but also that everybody else on the payroll is behind him.

It is therefore just plain, old-fashioned horse sense for management to recognize as its responsibility that it must aim ever toward a better deal for its entire working force. Frankly, we feel it is just as big a part of the job to keep the fellow in the ranks dynamically loyal as to keep the general manager on his toes. Both are important, but there are more fellows in the lower ranks than close to the top.

When we come to the responsibility of management to the customers, we are in no sense losing sight of their primary importance just because we list them third in order. Without the customer any business comes to an abrupt and groaning halt. But it is impossible to assure the customer the kind of product and service he demands unless the business has the financial stability that comes from fair treatment of stockholders, and the production stability and quality improvement that come from cordial cooperation with its working force.

Management's responsibility to the customers includes not only continuity of delivery and improvement of product, but also lowered prices as costs yield to intelligent treatment. Most business works steadily in this direction, if only under the compulsion of competition. Consider, if you will, what has been happening in the steel industry during recent years.

Steel Isn't Just Steel

It used to be that steel was pretty much standardized. There was a time, when, for example, a product called full-pickled, full-cold-rolled sheets existed. From these were made automobile doors, body panels, hoods, fenders, cowls. Today there is no such thing as a general product for automobile bodies. Our engineers, and the engineers of our competitors who also serve the automobile makers, go out into the automobile plants and determine the qualities that a steel must have to do a given job. There are, for instance, fenders formed to such difficult shapes that they require a very special fender steel. A given part of one car requires certain qualities to be formed most economically by the presses, the same part of another car requires a different set of qualities.

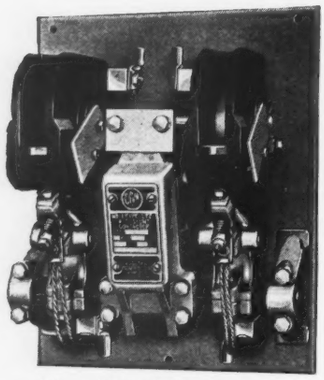
What this means to the steelmaker in engineering service, in laboratory experiments, in the actual operations of his plant can well be imagined by any production man in any industry. It has brought about so great an addition of personnel that, despite the development of continuous rolling, we today employ 1.57 men per 100 tons of steel shipped, whereas in 1923 with much less efficient production methods we employed 1.36 men per 100 tons shipped. This, incidentally, is an excellent commentary on the apprehensions of the free-for-all worriers who feel that technological progress is responsible for unemployment.

While we have been improving our processes and our service, we are getting $62 per ton for automobile fender sheet as compared with $135 per ton in 1923—46 per cent of the price of

EC&M WELDER CONTACTORS

...for Spot, Gun and Similar Welders

New EC&M 50 Amp. Type Z Enclosed Welder Contactor



No. 1 ***LINE-ARC*** Contactor

These are heavy duty, fast-operating Contactors, sturdily built to withstand successfully the exacting requirements of welder service. Due to the use of high-strength, light-weight construction, these contactors are capable of high speed operation. They are available in several sizes, the smallest, shown above, has a continuous ampere rating of 50 amperes and a rating of 150 amperes for welding service.

The Nos. 1, 2, 3 & 3-A Contactors are of ***LINE-ARC*** Design, which scientifically controls the arc by the ***LINE-ARC*** Principle. This not only materially increases contact life but eliminates destructive burning on the arc shields.

Many hundreds of these contactors are operating successfully on practically every type of welding machine. Use the convenient coupon below for complete data on EC&M Welder Contactors. Fill it out and mail today.

THE ELECTRIC CONTROLLER & MFG. CO. E&M CLEVELAND, OHIO

HEAVY DUTY MOTOR CONTROL FOR CRANES, MILL DRIVES AND MACHINERY • BRAKES • LIMIT STOPS • LIFTING MAGNETS AND AUTOMATIC WELD TIMERS

THE ELECTRIC CONTROLLER & MFG. CO.
2688-F East 79th St., CLEVELAND, OHIO

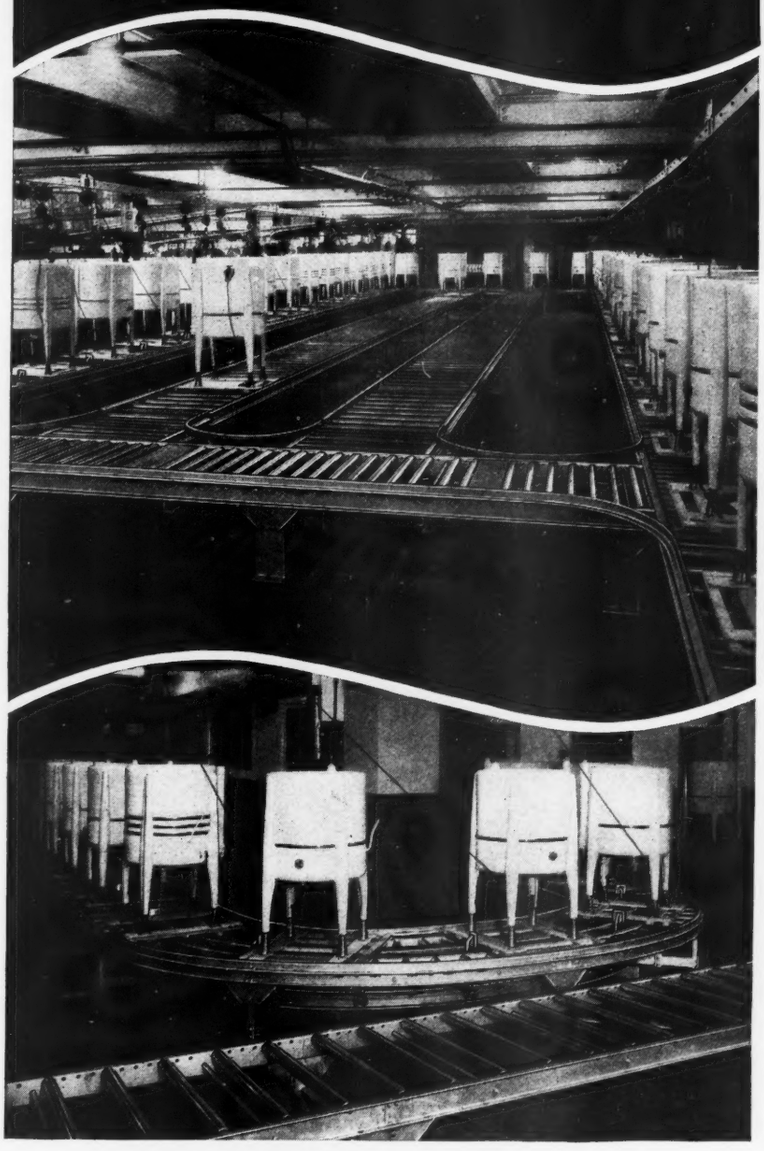
Gentlemen:
Please send me Bulletin 1210 describing EC&M Magnetic Contactors for Welder Service.

NAME .....

COMPANY .....

ADDRESS .....

These LAMSON CONVEYORS *enable the* EASY *Washing Machine Corp.*



"to build a better machine, freer from finish defects than ever before in the history of the company."

THE quotation is taken from a letter by Mr. C. A. Houseknecht, Easy's factory manager. It adds another to the long list of *reasons* why important industries are installing Lamson Conveyors—the reason of *improved quality in the product.*

Says Mr. Houseknecht: "*This conveyor completely cleaned up the Assembly Department and took away all the hard work on the test floor. It also did away with damage to machines, saving repair expense.*"

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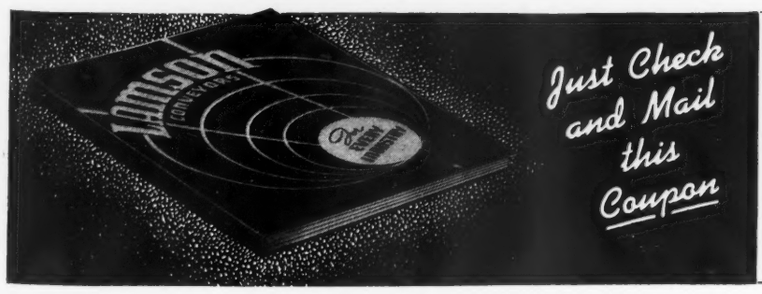
Top picture: From the moment when the legs are first set up, until the finished washer is test-approved, Easy Washers are never removed from this Lamson Conveyor. An overhead electric trolley supplies the power for running tests.

Lower picture: Even through the silence-test room where electric ears listen for noises, the silently rolling Lamson Conveyors carry the assembly.

LAMSON CONVEYORS



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Responsibility to the public is so obvious that most managements today take it for granted. There is, in such a shift as that just cited, so clear a case of better public service that nobody can properly dispute it. The impractical fellow says: "Yes, but your continuous strip mill displaced a great many workers, even though you are employing more men per ton of production than before. If you hadn't gone to the continuous method, and still sold as much steel, you would be using a lot more people." To which the answer is, of course, if we and the other steelmakers were not using a more economical method of producing sheets, there would not be so many automobiles sold, or refrigerators, or literally hundreds of other products that have been able to expand their markets on the aggregate savings in price made possible by improvements in the plants of their suppliers and of themselves.

Wise management constantly keeps in mind the public interest. It could not be otherwise. Industry serves the public well or it goes out of business. On the other hand, management has an obligation to keep the public informed about the services it is performing in the public interest. In our company we try to keep fresh in the minds of the people who live in our plant communities the useful function that Armco performs, and also the recognition of Armco as a good citizen that carries its share and more wherever it can. Through active participation in organizations covering more territory, members of our management group undertake to do our part in spreading a nation-wide recognition of the service of industry. Any well-managed business that does this, meanwhile serving well its owners, its employees, and its customers, is in our opinion on ground it can defend against all comers.

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How to Convert Projectors for Motion Study

(Continued from page 50)

revolves twice per frame giving four interruptions.

These shutters were replaced by the one shown at the left of Figure 1, which consists of a single shutter blade made of 0.01-inch-thick sheet duralumin, mounted on a duralumin pulley. The light shutter blade reduces the inertia, promoting rapid variation in speed and obviating the need for counter balancing. In later conversions it has been found satisfactory to use the original pulley equipped with a duralumin shutter.

If two of the sectors on the three-blade shutter are removed so that the light is interrupted only when the film is in motion, the light interruptions, at speeds of from two to three frames per second, while noticeable, are so far apart that they are not distracting, since the eye concentrates on the action rather than on the flicker. At normal speed the flicker is noticeable and causes unsatisfactory projection.

The advantage of this projector lies in the possibility of operating it at two to three frames per second, which is slow enough for the observer to follow the continuity of action and obtain the effect of slow motion. It also is ideal

(Continued on page 138)

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To Keep Water In: Reservoirs, Concrete or Masonry Storage Tanks, Basins.

To Eliminate Seepage: Bridge Decks, Masonry Standpipes, Substructures, Foundation Walls.

To Protect Concrete and Masonry from Disintegration: Foundations, Abutments, Retaining Walls, Culverts, Sumps, Vats.

To Prevent Corrosion of Steel: Beams, Reinforcing Steel in Concrete.

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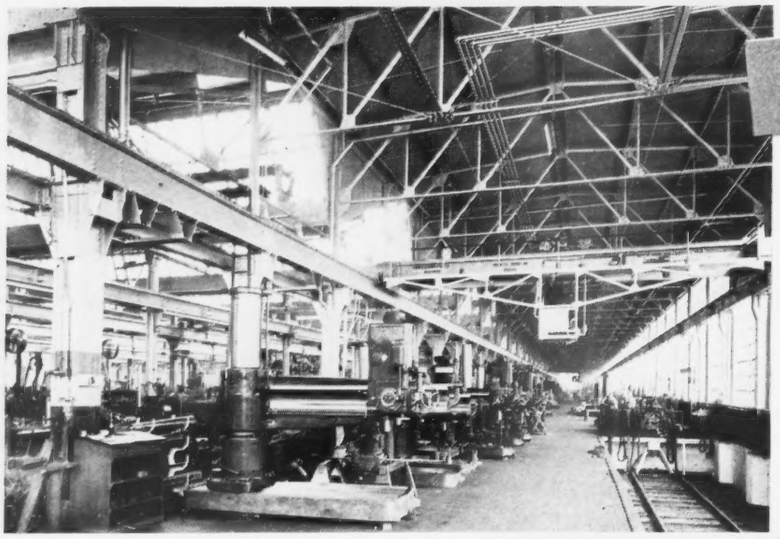

INDOORS

"Like a diamond in a new setting" is the way the Cincinnati Bickford Tool Company describes their plant interior after Aluminum Paint took the place of grime on steel work and walls. One coat hid the blackest surface. Workers could see better because its high reflectivity improved lighting.

Aluminum Paint is often used where severe dust conditions are encountered, as around this concrete mixing plant of the Henry J. Kaiser Company, Oakland, Calif. Aluminum Paint does not show dust readily. It stays attractively bright longer and gives, at the same time, lasting protection to wood or steel structures.

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for frame-by-frame projection because of the one light interruption per frame.

Newer models have a double-blade shutter which can be converted to a single-blade producing two light interruptions per frame. Flicker is less noticeable at normal speed, but at low speed it tends to become disagreeable. In spite of this disadvantage, this machine may be preferred since it is more of an all-purpose projector than the one that interrupts the light only once per frame. It may be used with a low-wattage lamp for normal projection at 16 frames per second without undue annoyance from flicker, and it may be used quite conveniently for film analysis.

The first projector converted was the Keystone D-62. This model, now obsolete, uses a 6-volt automobile headlight bulb as a lamp and operates only on alternating current. It is non-reversible and equipped with a three-blade shutter. The shutter was replaced by one with a single blade, and the 300-ohm rheostat by a 25-watt, 500-ohm, power rheostat with which the projector could be brought to a complete stop.

In order to make the projector reversible it was necessary to rewire the series motor so that the current through the armature might be reversed independently of the field. To do this the field leads were removed from the brushes and soldered together. Two wires were then soldered to the brushes and brought out together with the field leads.

A small double-pole double-throw switch was used so that movement of the handle in either direction would start the motor and an additional movement would lock the switch in place. This insures a very sensitive control of the motor, and at low speeds it is possible to advance one frame at a time.

Figure 2 is a wiring diagram and a sketch of the switch used. It must be pointed out that this machine cannot be made to take up the film on the reel when in reverse; this must be done manually.

The next projector converted, the Keystone A-72, comes non-reversible, but is equipped with a power rewind. The original shutter was replaced by a single-blade duralumin shutter, and the 300-ohm rheostat by one of 500 ohms. By interchanging the original upper and lower reel spindles with a set having negative feed clutches, and substituting a large gear with double pulley for the old single-pulley gear, the projector was made completely reversible.

Some alterations had to be made in the projector itself. Metal had to be cut away at point *a* (Figure 3), so that the pulley would slide all the way down the shaft to *b*. At *c* a piece had to be removed to allow the belt to enter the pulley on the big gear. It was also necessary to add a sheet metal guard for the upper reverse belt at *d*. Figure 1 shows the gears and spindles.

On this machine the rheostat and reversing switch were placed in a separate control box which is seen together with the projector in Figure 4. One of the two snap switches shown is used for turning the projector lamp on or off; the other operates the small pilot light on the control box, which is used to illuminate the desk when recording data. This box was made of square aluminum tubing 3 inches to the side and about 4½ inches long, with end panels of black plastic.

The control box is connected to the projector by means of a six-conductor, rubber-covered cable which plugs into a socket mounted on the side of the projector's original rheostat housing. The cable is about 6 feet long but has been successfully used for lecture demonstration with a 30-ft. extension.

All operations—turning on the projector light, starting, stopping, reversing and changing speed of the projector—are done by the control box. To keep the box from sliding on the table, four ½-in. soft rubber grommets were inserted in the bottom. The wiring diagram is given in Figure 5, in which P_1

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is the projector lamp and P_2 the pilot light. The motor on this model must also be rewired to make it reversible.

Standard equipment for the A-72 is a 300-watt lamp, which is a little too powerful when much low-speed projection is to be done. This lamp should be air cooled, and consequently the projector has to be run at full speed. For this reason it was replaced by a 100-watt lamp which will operate without an air blast, but even with this lamp the projector cannot be stopped for more than a few seconds without blistering the film. This trouble was overcome by mounting a ¾-in. disk of heat-absorbing and heat-resisting glass between the lamp and the film. It is shown in the holder at *e* in Figure 3. With this glass the film can be stopped for prolonged periods without injury.

The A-81 is the latest model projector and is the one most easily converted. It is equipped with the reversible feature and the only changes required are rewiring to fit the control box, inserting the heat-absorbing filter, and changing the shutter. The 750-watt lamp with which it is equipped must not be used when the projector is run slowly and should be replaced by a 100- or 200-watt lamp.

Controlling Work in Process

(Continued from page 47)

were purchased from outside sources. All final assemblies were conveyorized. The manufacturing interval represented a period of six to eight months. Control of work in process was a serious and important problem until the principles outlined here were applied.

In another instance, the control principles were applied to specialized production of equipment in which the order quantities were quite small, but a large number of parts were involved. It was concretely demonstrated that small-volume conditions require the same type of control as does mass production. Orders of only a few units cannot afford to carry the burden of unnecessary costs resulting from improper control.

It has been the purpose of this article to present the problem of work-in-process control, and to discuss the basic principles involved in the solution of the problem. In a subsequent article, the mechanics of applying these principles will be given.

•

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(Continued on page 142)

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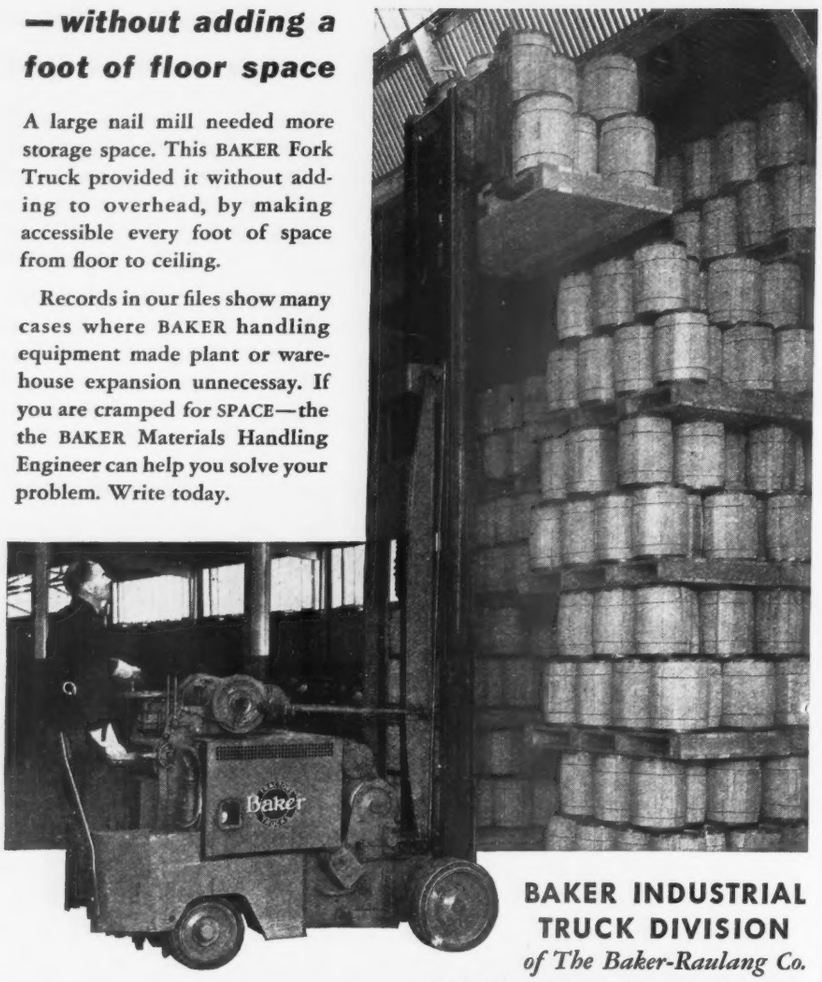

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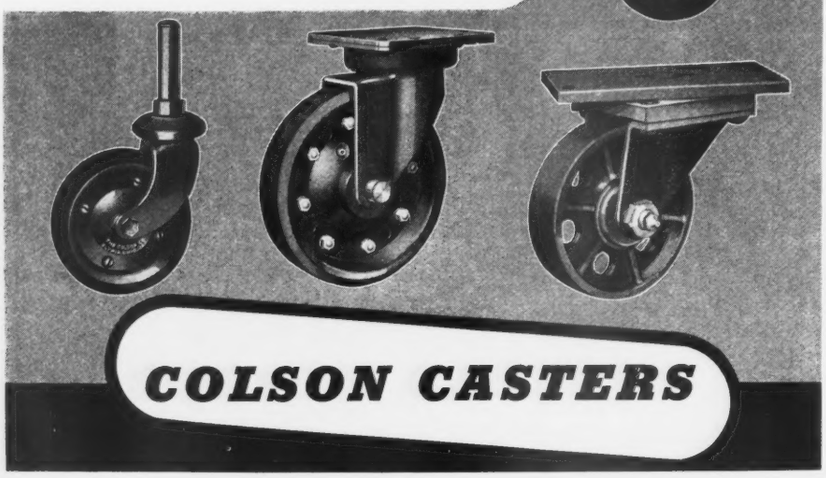

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(*Continued from page* 140)

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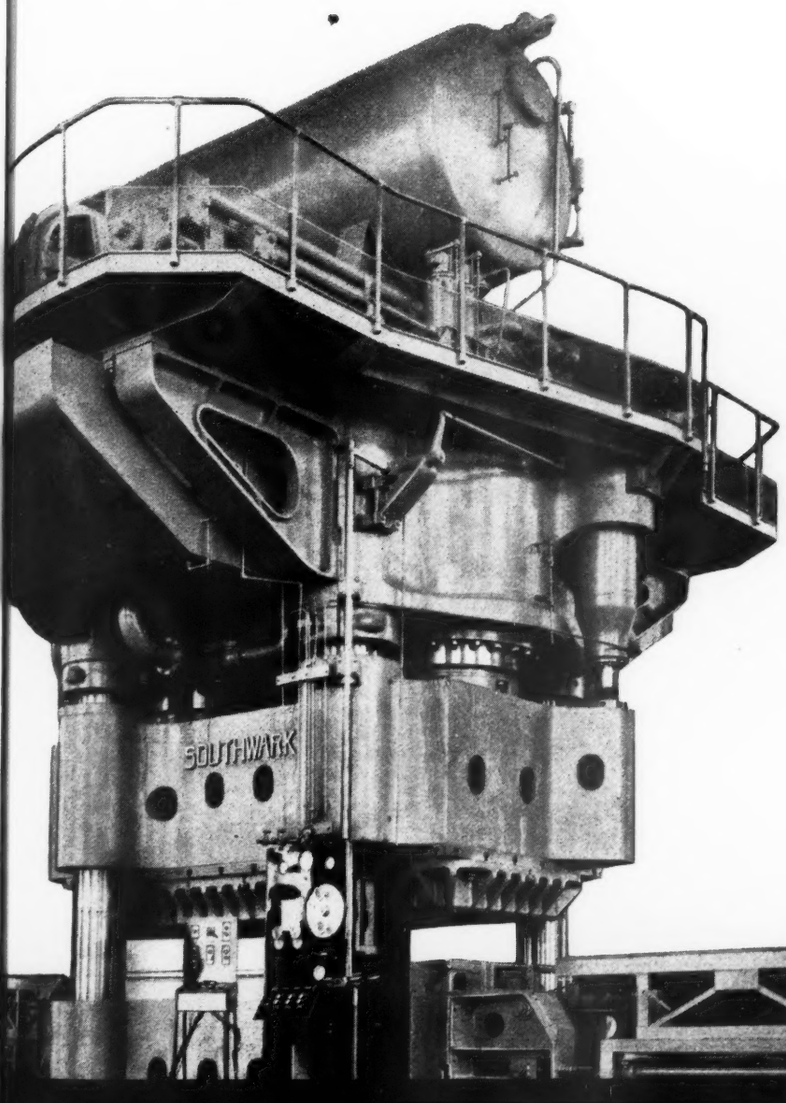


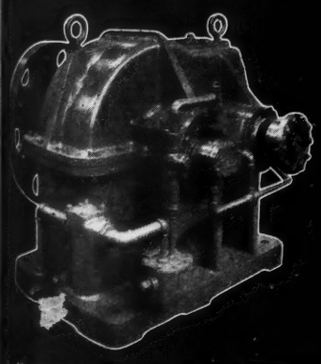
Economical and efficient, Harrison Heat Exchangers are effectively cooling both oil and water in various types and sizes of modern machines. The proven dependability, long life and low operating cost of these heat transfer units have made them the choice of engineers faced with the problem of cooling high-speed and heavy-duty machines.

Backed by years of practical experience, Harrison engineers are prepared to assist you with your cooling problems. With the facilities of Harrison's modern testing and research laboratories at their disposal, these engineers are in a position to render you valuable service.

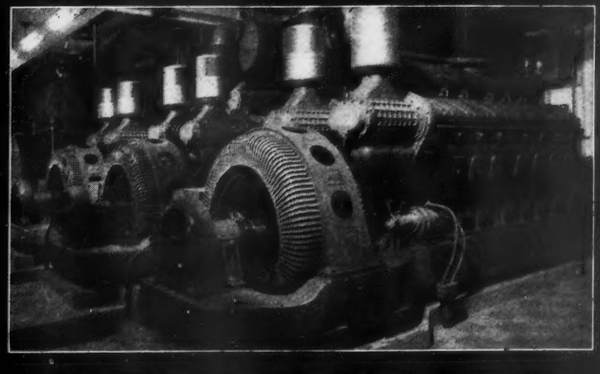
Write for complete information on the type and size of Harrison Heat Exchanger best suited to your requirements.

HARRISON RADIATOR DIVISION
General Motors Corporation
Lockport, New York

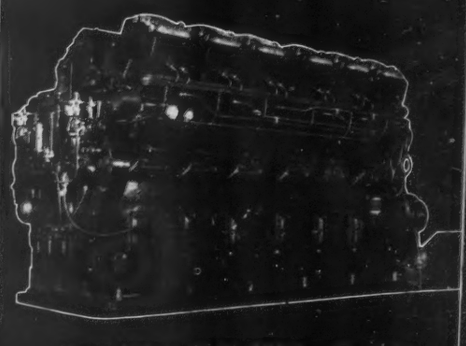
The oil in this giant, 5,500-ton Baldwin-Southwark hydraulic press is cooled by three Model 80-100 Harrison Heat Exchangers.



Model 212 Harrison Heat Exchanger provides dependable oil cooling for this Westinghouse Type SU-14 Speed Increaser.



These three 1,050-h.p. General Motors Diesel generator sets equipped with Model 124 Harrison Oil and Water Coolers furnish electricity for the Du Pont Building, Miami, Florida.



Two of these V-12, 500-h.p. Cummins Diesels drive the General Electric-built Diesel-electric locomotive used by the Fort Worth and Denver City R. R. Model 121 Harrison Heat Exchangers cool the lubricating oil.

THE WESTON MULTI-RANGE AC CLAMP-AMMETER

quickly detects these losses

A quick "Clamp-Ammeter" check showed the motor drawing an excess of 10 amperes — the reason, a tight bearing and belt. Immediately corrected, the energy saved amounted to over $90.00 yearly. » » » This was just one of the costly power losses quickly uncovered in this plant with the Clamp-Ammeter . . . the kind of loss that might be found in 'most any plant where systematic testing of electrical equipment is not a customary routine. » » » But now . . . with Clamp-Ammeter testing so simple . . . requiring so little time . . . plants everywhere are adopting this modern test procedure. The Clamp-Ammeter is simply hooked over the conductor for current readings. There is no interruption to production as the circuits are not disturbed. Let us send you the complete facts on this modern, inexpensive maintenance tool. Write for Bulletin A-2-B today. Weston Electrical Instrument Corporation, 628 Frelinghuysen Avenue, Newark, New Jersey.

— Close jaws around conductor
— Read current

6 current ranges 10/25/50/100/250/500 amperes. Higher ranges on special order

For insulated or non-insulated conductors up to 2" dia.

Sturdy Bakelite construction. High insulation protects operator and prevents short circuits

WESTON *Instruments*

Tools for efficient maintenance . . . the WESTON Clamp-Ammeter and the Junior Voltmeter.

terrupted cutting with Kennametal tools. —McKenna Metals Co., 130 Lloyd Ave., Latrobe, Pa.

Lubricating System—Catalog 75. Hydraulic-automatic, high- and low-pressure lubricating systems. Installation diagrams.—Bowen Products Corp., Auburn, N. Y.

Machine Tools—Binder. Performance data and specifications on Gisholt lathes and machine tool parts.—Gisholt Machine Co., Madison, Wis.

Maintenance — Handbook. Preservatives, coatings, waxes and wax removers, cements, concretes, for floors, walls, roofs. Requests should be sent in on letterhead with title of inquirer.—Flexrock Co., 2309 Manning St., Philadelphia.

Mechanical Power Transmission—Handbook 1600. A 272-page book for design engineers and plant managers on mechanical power transmission units—design, application data, dimensions, weights, list prices; self-aligning ball- and roller-bearing units; unmounted radial thrust bearings; friction and jaw clutches; welded-steel base plates.—Link-Belt Co., 307 North Michigan Ave., Chicago.

Metal Protection—Folder. "Amco" galvanizing powder and tinning compound for making repairs on hot-dipped galvanized and tinned equipment. Coating tumbler for application of metallic coatings.—American Solder and Flux Co., Wayne Ave. & Berkley St., Philadelphia.

Motor and Maintenance Equipment—Catalog J-239. Complete line of products described and illustrated. Hints on commutator care, operation of d.c. generators, definitions of electrical terms, engineering tables.—Ideal Commutator Dresser Co., Sycamore, Ill.

Oil Circuit Breakers—Catalog 6-c. Hand-operating mechanisms and attachments, typical mounting arrangements for "Turblator" oil circuit breakers.—Roller-Smith Co., 1766 West Market St., Bethlehem, Pa.

Packaging—Pamphlet AD9. Cutting costs in packaging with "Steelstrap" by the unit-load process.—Acme Steel Co., 2840 Archer Ave., Chicago.

Paper-Mill Cleaner — Handbook and Price List. "Paper Mill Cleaning Handbook" covers removal of slime, cleaning of screens and head boxes, screen couch rolls sand water filters, stock filters, cleaning and conditioning of felts, use of wetting agent in beater.—Magnus Chemical Co., Inc., Garwood, N. J.

Power Cable—Catalog C-42. Physical and electrical characteristics for rubber-insulated power cables, coding details of control cables, technical data, tables on current-carrying capacity. — Anaconda Wire and Cable Co., 25 Broadway, New York.

Power Tools—Form 162, Catalog 339—Section B. Portable electric and heavy-duty saws, door planes, door mortisers, disk sander.—Mall Tool Co., 7740 South Chicago Ave., Chicago.

Printing Machine—Folder. "Portaprint" for producing positive prints of important papers direct from originals.—Eberbach & Son Co., Ann Arbor, Mich.

Pulleys—Bulletin and Data Sheet. Variable-speed pulleys with 6:1 ratio. Specifications and dimensions. — The Speedmaster Co., Division of Continental Machines, Inc., 1301 Washington Ave. South, Minneapolis.

Pumps—Bulletin W-321-M3A. "Jetflo" deepwell pumps. Operation, ratings, and prices.—Worthington Pump & Machinery Corp., Harrison, N. J.

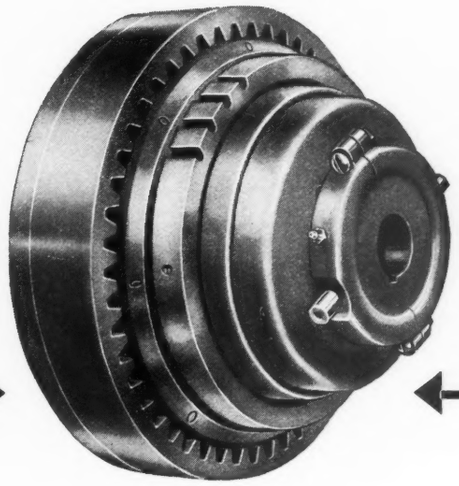
Reflector—Form 5139. "Reflecto-Duct" reflector for fluorescent lighting. Models, prices, sizes.—Reflectors, Inc., 3225 Frankford Ave., Philadelphia.

Refrigeration Unit—Bulletin CR-127. "Conditioned Cold" refrigeration condensing unit of ¼ and ⅓ hp., adaptable to general refrigeration uses, for self-contained applications.—Carrier Corp., Syracuse, N. Y.

Scooters—Folder. Motorized scooters for delivery service. Illustrations of models.—Moto-Scoot Mfg. Co., 8434–40 South Chicago Ave., Chicago.

Screw-Size Chart—Rotary chart for drafting room use in determining dimen-

New Disc Type Friction Clutch



MEDART "ARROW-M"

Smooth » » Positive » High Torque » Engagement

This new Medart "Arrow-M" Disk Type Friction Clutch is designed to meet the requirements of modern power transmission drives and all types of special machinery applications . . . It has many desirable and exclusive features—

1. Positive, smooth engagement is accomplished thru a high leverage toggle system of alloy steel links

2. Maximum torque is transmitted from driving to driven members—

3. Positive separation of the friction plates is insured by disengaging lever pull and centrifugal force action on the toggle mechanism

4. Long wearing replaceable friction facings are riveted to each side of the driving discs—asbestos or all metal composition

5. Simple to adjust—a turn of one adjusting ring gives balanced adjustment on all friction surfaces

6. Available with pin type or gear tooth type driving plates—in multiple or single plate construction

Valuable clutch engineering and application data is contained in New Arrow-M Bulletin . . . Send for your copy.

MEDART TIMKEN BEARINGS: Available in four (4) types: the "SS" Series for general purpose application, the "TS" Series for higher speeds and shock loads, the "DM" Series for conveyor and machinery application, and the "DC" Series for light duty application.

MEDART GEARS: Every type for every purpose—spur, bevel, mitre, angle or worm—machine molded, pattern molded or cut tooth. Modern manufacturing.

THE MEDART COMPANY

3512 DeKalb St. • • • St. Louis, Mo.

MEDART

Protect Your Workers with MORTON'S SALT TABLETS

Heat-Fag and hot weather travel together. You can't stop the weather —but, you *can protect your workers against Heat-Fag* and stop the sag in the production line by placing Morton's Salt Tablets at every drinking fountain. These handy little tablets represent the easiest and most convenient way to replace the vitally needed body salt that's sweated out by hard work on hot days.

MORTON'S SALT TABLETS
Dissolve in 50 Seconds

Workers find them easy to take with a drink of water. They dissolve quickly. Only the purest and most highly refined salt is used.

MORTON'S DISPENSER . . . Sanitary, Economical, Convenient

This modern dispenser represents the most efficient method yet perfected to supply salt to employes. Streamlined and attractive, they are dust-proof, dirt-proof and corrosion-proof. A single push of the lever at the base dispenses one tablet at a time.

Install Morton's dispensers and salt tablets in your plant now. Get ready for the hot days ahead. Remember — a small investment now will protect the health and efficiency of your workers when Heat-Fag threatens your plant. Shipments will be made promptly—prepaid.

Write for folder—**"Heat-Fag"**

MORTON SALT COMPANY
CHICAGO, ILLINOIS

sions of socket screws.—Parker-Kalon Corp., 200 Varick St., New York.

Shims—Chart 1142. Illustrated chart showing applications of laminated shims. —Laminated Shim Co., Inc., 21–86 Forty-fourth Ave., Long Island City, N. Y.

Shipping—Bulletin AD7. Bracing carload freight—mixed and uniform ladings —with steel strapping. Illustrations of methods used.—Acme Steel Co., 2840 Archer Ave., Chicago.

Showers—Leaflet R235. Group showers with treadle control.—Bradley Washfountain Co., Milwaukee.

Speed Control—Folder. How to "save money and improve processes" by using variable-speed control.—Reeves Pulley Co., Columbus, Ind.

Speed Reducers—Catalog 7838. Construction data, dimensions, horsepower ratings of "Saco" speed reducers.—Stephens-Adamson Mfg. Co., Aurora, Ill.

Steam Turbines—Booklet B. 2198. Application and selection of steam turbines in sizes up to 10,000 kw. Illustrations, charts, diagrams, cross-sectional views.—Westinghouse Electric & Mfg. Co., Dept. 7-N-20, East Pittsburgh.

Steel—1939 Stock List. A 252-page stock list and reference book. Tools, accessories, alloys, parts, punches, machinery.—Scully Steel Products Corp., 1319 Wabansia Ave., Chicago.

Steels—Chart. "Average Physical Properties of Various Steels." Includes tensile strength, yield point, elongation, reduction of area, hardness, of approximately 50 different types of steels.—Joseph T. Ryerson & Son, Inc., 16th & Rockwell Sts., Chicago.

Strainer Head—Leaflet 2217. Expansible strainer head for filter and softener underdrain systems.—The Permutit Co., 330 West 42d St., New York.

Switchboards—Descriptive Data 31-133. Small-capacity (250 kva. at 240 volts, 500 kva. at 480 volts) a.c. switchboards with knife switches and fuses for parallel or non-parallel operation. — Westinghouse Electric & Mfg. Co., Dept. 7-N-20, East Pittsburgh.

Testing Instruments—Two Bulletins. 1600: Six types of testing instruments operating on the "Megger" cross-coil ohmmeter principle. 1605: Chart showing resistance range covered by the testers (one-millionth ohm to 20,000 megohms).—James G. Biddle Co., 1211-13 Arch St., Philadelphia.

Time Recorder—Bulletin 93. "Electro-Touch" time recorder with card-locking device to prevent misplaced registrations. —Simplex Time Recorder Co., Gardner, Mass.

Tools—1939 Catalog. Fifty-six pages of portable electric tools. Includes the new 3/16-in. Hornet Drill, 5/16-in. Ball Bearing Utility Drill, No. 36 Portable Electric Hammer.—The Black & Decker Mfg. Co., Towson, Md.

Tools—Catalog 39. A 91-page catalog on complete line of tools—wrenches, hammers, pliers, benders, cutters, cabinet sets, chisels.—Bonney Forge & Tool Works, Allentown, Pa.

Truck—Bulletin A-630. Standard- and junior-type load-skidders. Draw-jack.—Electric Wheel Co., Quincy, Ill.

Trucks—Bulletin 1256. Type 3-EFT-106 fork trucks including telescoping and tilting features.—The Atlas Car and Mfg. Co., Cleveland.

Tubing—Bulletin SS-25. Seamless flexible metal tubing. Use in conveying steam, liquids, gases; in controlling vibration; connecting misaligned and moving parts; product design. Engineering data, specifications, installation rules.—The American Brass Co., P. O. Box 791, Waterbury, Conn.

Valves—Bulletin 1223. Specifications for self-contained electric control valves for throttling gas, oil, or air flow to furnaces, ovens.—Wheelco Instruments Co., 1929–33 South Halsted St., Chicago.

Viscosity Meter—Bulletin 701. Specifications on Saybolt Viscosimeter for testing oil viscosity.—Precision Scientific Co., 1750 North Springfield Ave., Chicago.

Water Conditioning—Bulletin. "Conditioning Water for the Paper Mill." Talk

Cut Down Product-Parts... Reduce Assembly Operations

THROUGH THE USE OF BAKELITE PLASTICS

THE SMALLER the number of parts which comprise your product, the fewer the operations required to assemble it. This axiom is exemplified in many well-known products made in whole or in part of Bakelite Plastics. One such product is the Diehl Ribbonaire Fan. Every available short-cut in fabrication and assembly was incorporated in the design and manufacture of this ingenious electrical device.

Component parts were held to a minimum. Size was curtailed perceptibly, weight reduced 50% to 80%. Machining requirements were cut considerably. Tapping and counterboring were eliminated entirely. The whole assembly is completed with the least number of operations.

Many additional benefits accrued, among them: instant approval from international Boards of Underwriters because of the insulating properties of Bakelite Molded—and elimination of all finishing operations due to the self-contained color and lustre of this material.

The use of Bakelite Plastics would, in all probability, contribute comparable advantages to the economy and efficiency of your product. Investigate the properties and possibilities of these materials. Write for the informative booklets in Portfolio 16, which describe many types and applications of Bakelite Plastics.

BAKELITE CORPORATION, 247 Park Avenue, New York
Chicago: 43 East Ohio Street
BAKELITE CORPORATION OF CANADA, LTD., 163 Dufferin St., Toronto, Ont.
West Coast: Electrical Specialty Co., Inc., San Francisco, Los Angeles and Seattle

Bosses molded in the Bakelite Plastic base are ready to receive self-tapping screws.

A single molding operation forms the entire base including lettering, trade-mark and switch-port.

The motor-housing mold creates these ribbon-blade slots, thus making unnecessary a painstaking machining operation.

This countersunk through-hole is formed as an incidental in molding the upright arm.

BAKELITE

REGISTERED U. S. PAT. OFF.

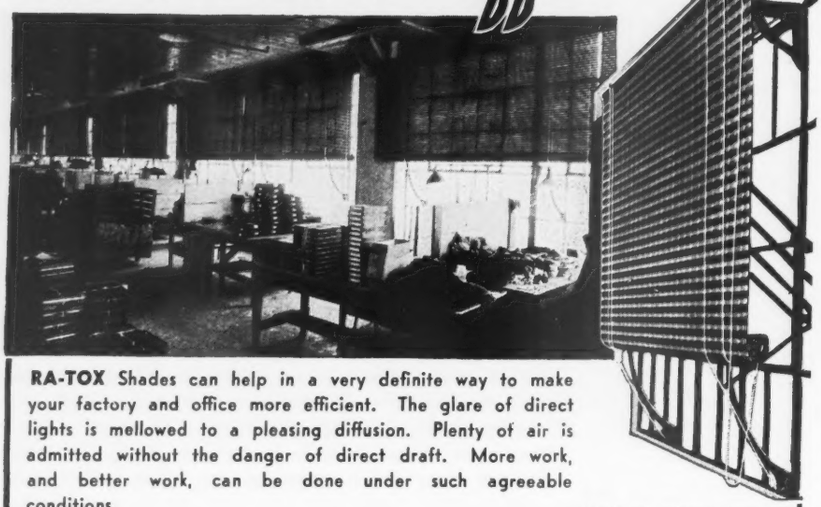
The registered trade marks shown above distinguish materials manufactured by Bakelite Corporation. Under the capital "B" is the numerical sign for infinity, or unlimited quantity. It symbolizes the infinite number of present and future uses of Bakelite Corporation's products.

PLASTICS HEADQUARTERS

VISIT THE BAKELITE EXHIBIT, HALL OF INDUSTRIAL SCIENCE, NEW YORK WORLD'S FAIR 1939

Stop that Costly
IDLE TIME
of Machinery!
But first you must see it. The Servis Recorder shows you. See how "time down" stands out on the chart below. You can't miss it. You can't help but reduce it! Suppose you could reduce idle time on all your factory machinery merely 10 minutes a day! What would it amount to in a year —or even a month! More than you'll ever save by "little economies."
The Servis Recorder bolts or clamps right on the machine itself—no ink, no pencils, no electric wires. Send for folder. The Service Recorder Co., 1422 Euclid Avenue, Cleveland, Ohio.
Stop of 40 minutes waiting for material
Late start after lunch period
Three 10-minute stops—machine jammed by poor material
Didn't get started until about 9 a.m.
Machine idle for half an hour... why?
Machine stops half an hour before quitting time
Night shift not working
Heavy Lines Show Busy Time
THE SERVIS RECORDER
The "Time Clock" for Machinery

RA-TOX FOR Efficiency



RA-TOX Shades can help in a very definite way to make your factory and office more efficient. The glare of direct lights is mellowed to a pleasing diffusion. Plenty of air is admitted without the danger of direct draft. More work, and better work, can be done under such agreeable conditions.

RA-TOX Shades have proved their efficiency in leading factories throughout the country. They are available in narrow splints as well as standard width; square-edge splints and bevel-edge splints; and in three finishes—stain, metallic aluminum, enamel.

Write us today and let us show you by word and picture how **RA-TOX** Shades have benefited many factories and offices, and how they give service for years and years.

Made of selected basswood strips, woven parallel with hard twist seine twine; attractive, fast colors add smart, business-like appearance.

HOUGH SHADE CORPORATION
1043 Jackson St., Janesville, Wis.
Send complete RA-TOX details at once.

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Address.....
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State.....
☐ Steel Sash ☐ Wood Sash

presented at the Southern Paper Festival in Savannah.—The Permutit Co., 330 West 42d St., New York.

Water Coolers—Folder. Bottle- and bubbler-type coolers in five models.—Cordley & Hayes, 145 Hudson St., New York.

Water-Cooling Units — Bulletin 239. Electric water cooler for single and multiple installations operating from a remote refrigerating unit. Installation diagrams.—Cordley & Hayes, 145 Hudson St., New York.

Water Softener—Bulletin 602. Four types of zeolite water softeners and their operating principles. Iron and manganese removal, aeration, external- and internal-type boiler-water conditioning systems.—Elgin Softener Corp., Elgin, Ill.

Water Softener—Bulletin 597. Zeolite water softening. Mining, processing, manufacture, and uses of zeolites.—The Permutit Co., 330 West 42d St., New York.

Water Treatment — Pamphlet. "Removal of Iron and Hardness from Water." Paper presented before New England Water Works Association.—The Permutit Co., 330 West 42d St., New York.

Welder—Welder Specification Bulletin 314-A. A 150-amp., "Shield-Arc Junior" welder with self-indicating, dual, continuous control. Also optional equipment. —The Lincoln Electric Co., 12818 Coit Road, Cleveland.

Wheelbarrows—Form W-1. Wheelbarrows with disk wheels, pneumatic tires, curved leg brace, interchangeable parts, double-tray bottom. Trays for wet concrete, sand, coal and ashes.—Red Star Products, Inc., 12910 Taft Ave., Cleveland.

Wiring Devices—Form 2280. Line of weatherproof wiring devices for single-gang installation.—Pass & Seymour Inc., Solvay Station, Syracuse, N. Y.

BOOKS

SIMPLE BLUEPRINT READING

The Lincoln Electric Company, 12818 Coit Road, Cleveland. 141 mimeographed pages, diagrams. 50c in the United States; 75c outside.

Treatise on the fundamentals of blueprint reading, with reference to welding and welding symbols, provides welders and those concerned with mechanical construction with information and instruction on the reading of blueprints and drawings. The discussion covers symbols used in drawings of different types of welded joints—butt, corner, fillet, lap—and is illustrated with 87 drawings of machine parts, pipe connections, general construction, tanks. List of questions and answers is included.

ON THE CALENDAR

JULY

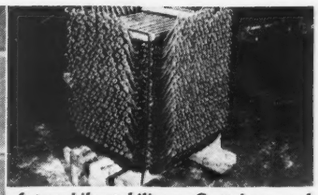
10–14, American Society of Mechanical Engineers, Semi-annual Meeting, San Francisco, C. E. Davies, Secretary, 29 West 39th St., New York.

AUGUST

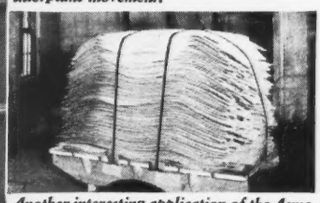
30–September 2, Silver Bay Conference on Industrial Relations, Silver Bay, N. Y. E. H. T. Foster, Executive Secretary, 347 Madison Ave., New York.

SEPTEMBER

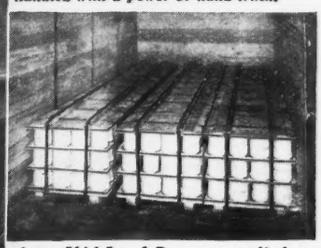
20–22, National Industrial Advertisers Association, Inc., Annual Conference, New York. Miss Mildred R. Webster, Headquarters Secretary, 100 East Ohio St., Chicago.



Automobile stabilizers. Containers and damage both eliminated. Handling costs cut by shipper and consignee. The same Acme Skid-Load Process can be used for interplant movement.



Another interesting application of the Acme Skid-Load Process is in the shipping of inner-sole leather. This skid is quickly handled with a power or hand truck.



Acme Skid-Load Process applied to spooled copper wire of well-known manufacturer. Investigate the Acme Skid-Load Process for economically and safely handling your own products.

Acme Steelstrap

Saved Us Money for Years . . .

NOW WE'RE EFFECTING STILL FURTHER ECONOMIES BY USING THE ACME SKID-LOAD PROCESS!"

Handling costs are reduced—the danger of damage to shipments is minimized—time and space are saved—customer good-will is built up. These and many other advantages have been instrumental in effecting important shipping economies for shippers the country over.

Shown at the right are a few typical applications of the Acme Skid-Load Process, which enable more efficient, more economical shipment of products for all industries. By use of the Acme Skid-Load Process many individual units can be converted into a single, compact package. Frequently, bulky and otherwise hard-to-handle shapes can be assembled into one easily handled unit—often the handling of heavy objects is greatly facilitated. Loading and unloading are accomplished with a minimum of manual effort.

Chances are that you, too, can effect important economies by using this time and money-saving method in the shipping and handling of your products. Write for the descriptive folder, illustrating some of the numerous ways in which various industries have lowered costs by the utilization of the Acme Skid-Load Process. Or ask for data on your own shipments. Suggestions are free. Just mail the coupon.

Iron cores from rolls of rotogravure paper are returned on skids by printers to paper mills. The load pictured weighs 3600 lbs., but Acme Steelstrap makes it "Bound to Get There."

Motor truck load of coiled strip steel on non-returnable skids. Coils held on inexpensive wood skids or pallets with Acme Steelstrap tensioned and sealed. Injuries to workmen reduced by eliminating manual handling of each coil.

ACME STEEL COMPANY

2831 ARCHER AVE., CHICAGO, ILL.

ACME SKID-LOAD PROCESS

FOR MAKING SHIPMENTS

"BOUND TO GET THERE"

ACME STEEL COMPANY
2831 Archer Avenue, Chicago, Illinois

☐ Send me the booklet describing the Acme Skid-Load Process
☐ Have the nearest Acme engineer call

Name.....

Address.....

City.....*State*.....

LINCOLN *Industrial* LUBRICATING EQUIPMENT

makes it easier for you to do a BETTER JOB of GREASING the machines in your plant . . . .

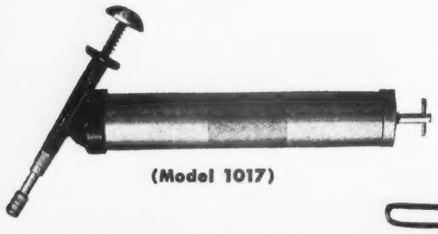
No matter how large or small your requirements—Lincoln makes lubricating equipment that will enable your men to do a better job of greasing your machines quickly, easily and thoroughly . . . The proven performance of these grease guns has created universal acceptance.

Today Lincoln Lubricating Equipment is being used in factories, mills, mines, roundhouses, on contractors' equipment, on farm implements, in the oil fields, and in many other places by those who realize the importance of utilizing the best equipment for lubricating bearings and other moving parts. The line is complete. It includes Hand Guns, Lever Guns, Bucket Pump, air and electrically operated Power Units in all sizes. Also Flex-O-Matic Systems delivering a predetermined shot of lubricant from a central source, through a single supply line, to a group of bearings on a machine.

(Model 309)

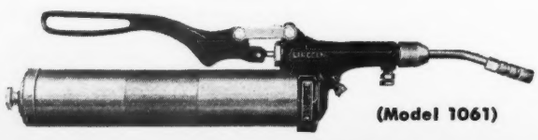
MODEL 309 TWIN CYLINDER AIRLINE LUBRIGUN (shown at left) dispenses lubricant directly from an original 100-lb. drum. This unit is capable of handling semi-solid oils, as well as viscous and fibrous greases. Mounted on a truck with 12″ rear wheels and swivel front casters. Easily pushed from job to job.

MODEL 1017 (shown below) is one of several models of KLEENSEAL Grease Guns. All models of this type provide a fast, clean method of lubricating machinery equipped with KLEENSEAL, Zerk or hydraulic fittings. Model 1017 has 14-oz. capacity. Maximum pressure—5,000 lbs. . . . Models are also available in 3½ . . . 5¼ . . . 9 . . . and 18-oz. capacity.



(Model 1017)

LEVER-TYPE GUNS are available in both high pressure and volume types, with attachments for all types of fittings. Model 1061 (illustrated) handles all types of lubricants and develops pressures up to 10,000 lbs . . . Capacity 18-ozs.



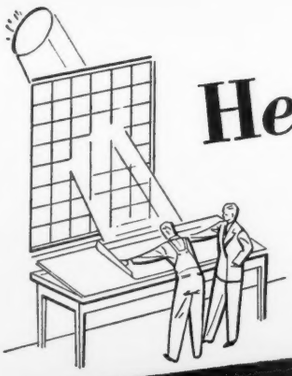
(Model 1061)

Obtain complete information on this complete line of grease dispensing equipment; also on Lincoln KLEENSEAL, Button Head Fittings and many special fittings. Consult your nearest Lincoln distributor—or write us for Catalog No. 60.

LINCOLN ENGINEERING COMPANY

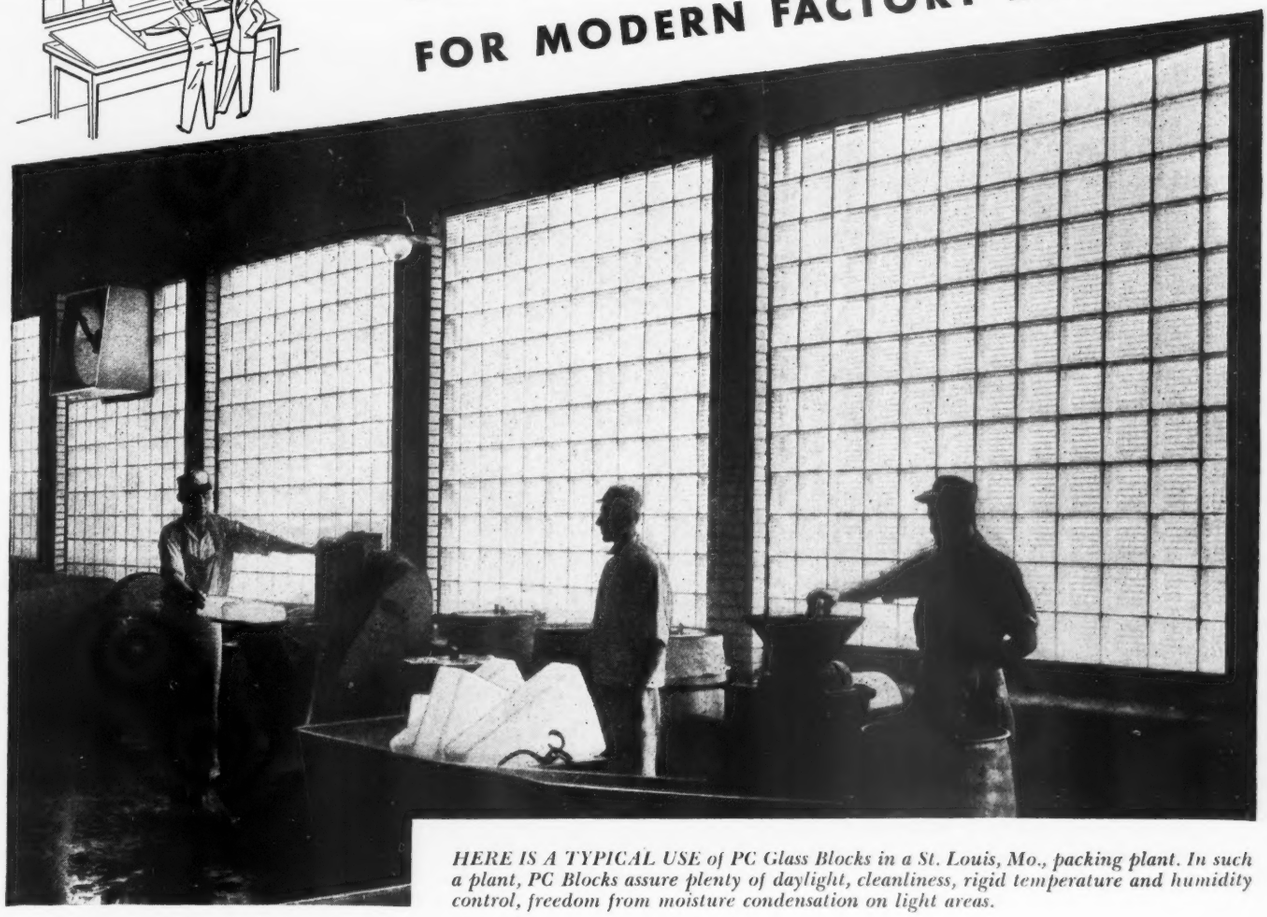
Pioneer Builders of Engineered Lubricating Equipment

ST. LOUIS, MO., U. S. A.



Here's Higher Efficiency . . . Lower Maintenance . . .

FOR MODERN FACTORY BUILDINGS



HERE IS A TYPICAL USE of PC Glass Blocks in a St. Louis, Mo., packing plant. In such a plant, PC Blocks assure plenty of daylight, cleanliness, rigid temperature and humidity control, freedom from moisture condensation on light areas.

PC GLASS BLOCKS provide advantages which definitely affect modern plants. They are conducive to better-lighted factory rooms, because they transmit daylight so generously and diffuse it so well. They aid greatly in temperature and humidity control, practically do away with moisture condensation on light areas, because they have a high heat insulation value. They eliminate dirt infiltration at light areas and thus protect delicate processes. They preserve privacy, aid workers' concentration, because they are non-transparent. And they effectively insulate against outside noises.

Further, PC Glass Block construction definitely produces substantial maintenance savings. PC Glass Blocks are completely resistant to chemicals, fumes and acid corrosion. There is no wood or metal sash to rot or corrode, to need constant repainting or replacement. The blocks are exceptionally easy to keep clean. And they save on fuel bills because of their high insulating qualities.

Here is a material which no man building or remodeling a plant can afford to overlook. Send the coupon for our free booklet of information about PC Glass Blocks. They are manufactured by Pittsburgh Corning Corporation.

At the New York World's Fair, see the exhibits of Pittsburgh Glass in the Glass Center Building, the Forward March of America Building and the All-Glass House. At the Golden Gate International Exposition, see the interesting Pittsburgh exhibits in the Homes and Gardens Building.

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PITTSBURGH PLATE GLASS COMPANY

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PITTSBURGH PC CORNING *Glass Blocks*

Pittsburgh Corning Corporation
2187-9 Grant Bldg., Pittsburgh, Pa.

Please send me, without obligation, your new book of facts about PC Glass Blocks entitled "The Glass Age Arrives."

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the money saving advantages of these two new MERCURY TUG TRACTORS

GAS POWERED MERCURY TUG

MODEL A-352

The power plant is a complete unit assembly which may be easily removed for service and re-installed by two men in less than an hour's time.

In addition to the exclusive unit assembly, the gas powered Tug offers many other important features.

- An unique reversing gear provides 3 speeds forward and 3 in reverse, plus an extra "low low" speed in either direction.
- Driver on front — providing ideal vision and operating safety.
- Four wheel model — 2 wheel shockless steering with Ross gear and hand wheel.
- Full floating patented internal gear drive.
- All welded, heavy plate, unit type frame.
- Semi-elliptic spring suspension front and rear.
- Speeds to 8 M. P H — maximum D. B. P. 2500 lbs.

Bulletin 185 contains full specifications.

ELECTRIC POWERED MERCURY TUG

MODEL A-540
MEDIUM DUTY HEAVY DUTY

In electric tractors the Mercury "Tug" can't be equalled for power — ruggedness or compactness.

- Drive Axle — double reduction, spiral bevel and spur gear type.
- Motor — high overload capacity — rubber cushioned.
- Controller — snap action, mechanical contactor type
- Brakes — internal expanding type in drive wheels.
- Frame — all welded, steel plate construction.
- Springs — semi-elliptic — front and rear.

Completely described in Bulletin 175.

MERCURY MANUFACTURING CO.
TRACTORS · TRAILERS · LIFT TRUCKS
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WALDRON SILENT STEEL GEARS

① STRONG! . .
because they are made of STEEL throughout

② SILENT! . . .
because they are made of steel laminations separated by graphite film

MADE IN SIZES FROM 2 INCH DIAM. AND UP

Construction advantages give these all-steel gears a usual life much longer than that of non-metallic gears. They avoid difficulty of tooth breakage and deformed tooth profile. They cut and hold true, strong Keyway and have large bore capacity. Ideal combination of strength, silence and long life for economy. Catalog on request.

Manufactured and Sold by the
JOHN WALDRON CORP.
NEW BRUNSWICK, N. J.

THE WORLD'S MOST REVOLUTIONARY GRINDER

Hold a horsepower in your hand with this revolutionary small diameter motor. Utmost simplicity cuts weight more than one-half. No gears, brushes, commutator, moving wires or centrifugal switch. No complicated accessories. Uses 220-volt, 3-phase, 60-cycle current at 3600 r.p.m. Patented features.

The Sawyer Hi-Power aerial grinder can be comfortably handled for hours without any suspension.

The Sawyer Hi-Power Aerial Grinder has a power-to-weight ratio that is higher than that of any other tool of its kind. Rated at 1½ h.p., it has a pullout of nearly 3½ h.p., and will operate on 50% overload for hours without danger to the windings. Small overall diameter (4⅞") provides maximum "get-at-ability" in service. Overall length, 24". Grinding clearance, 2". Totally enclosed motor—dust-proof, splash-proof, drip-proof. Thoroughly ventilated.

Sawyer Grinders with weight-saving motors are made in 1, 1½ and 2 h.p. Aerial Types; heavy duty, 3½ h.p. Suspended Aerial Type; 1½ h.p. External Tool Post Type; 3½ h.p. Hi-Speed, Heavy Duty Type, and 5 h.p. Hi-Speed Pedestal Type with Exhaust Guards.

Send for descriptive illustrated folder.

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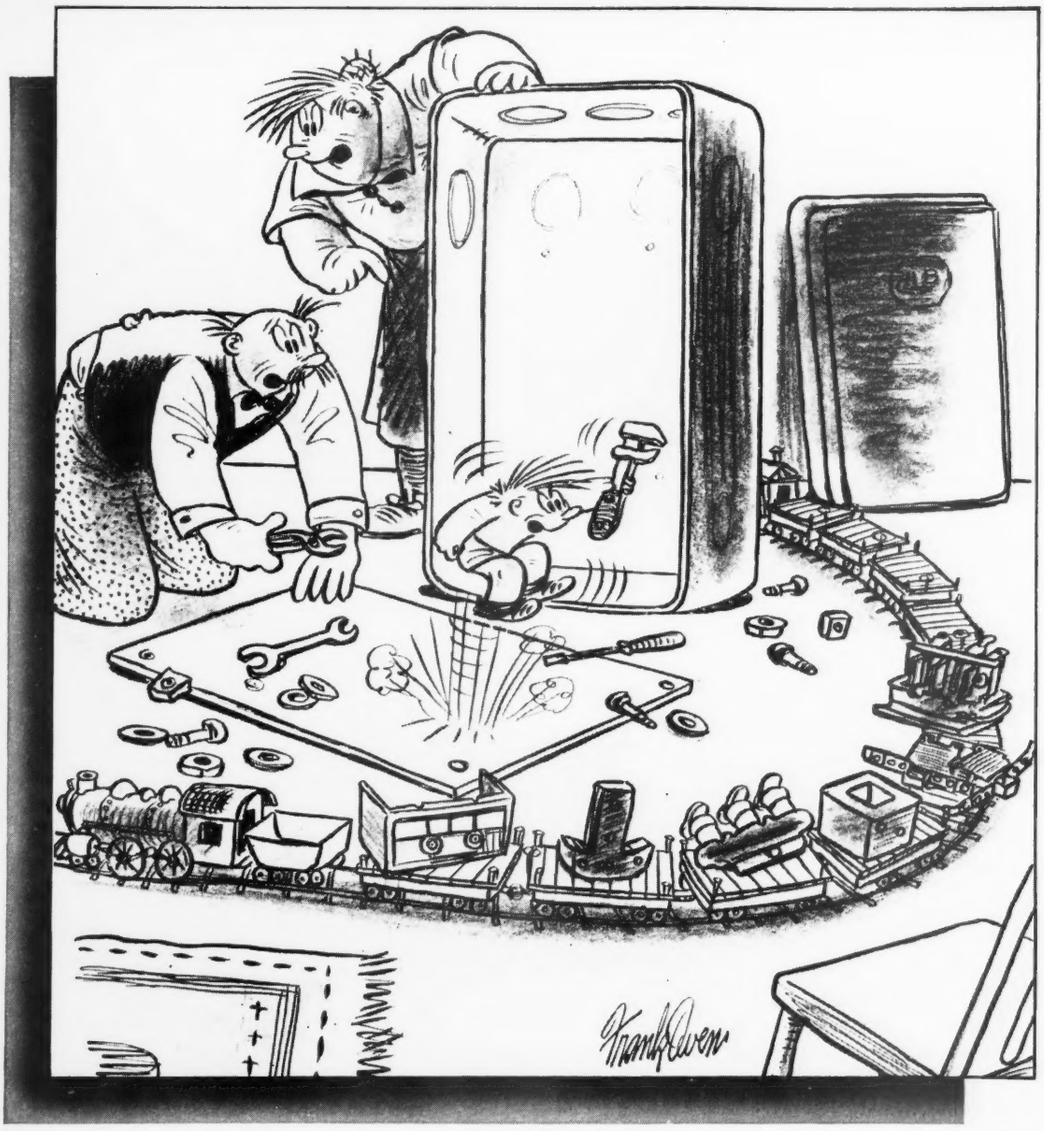
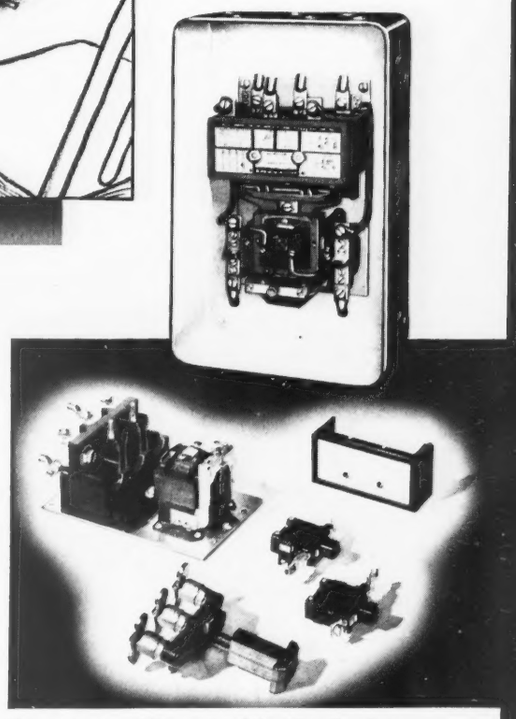
NO BRUSHES · NO COMMUTATION · NO GEARING
SAWYER
HI-POWER ELECTRIC MOTORS
MORE POWER · LESS WEIGHT · HIGHEST EFFICIENCY



"He says there are so few parts he can't fill up his train!"

A train load of parts in your starter may mean a train load of troubles for you. Allen-Bradley solenoid starters avoid trouble by their A-B-C simplicity. They have no complicated mechanisms to wear and cause trouble. They have no bearings, pins, or pivots to delay switch action.

Then too, the double break, silver alloy contacts on Allen-Bradley solenoid starters never have to be cleaned or filed. They are always in first-class operating condition. The efficient solenoid magnet holds in and keeps motors running in spite of poor line voltage conditions. Specify Allen-Bradley solenoid starters in your plant and bid good-bye to control troubles.



Here you see all the parts of the Allen-Bradley solenoid starter. What could be more simple?

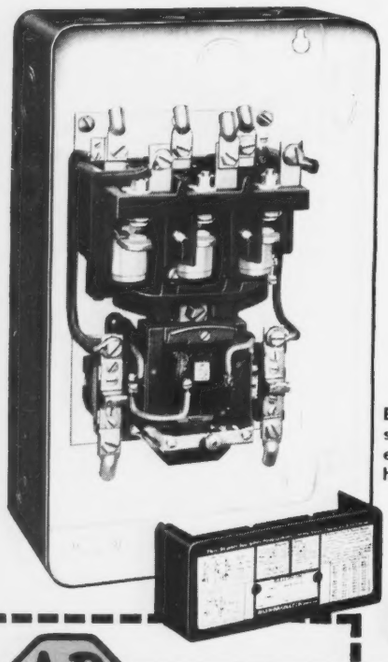
ALLEN-BRADLEY
SOLENOID MOTOR CONTROL

QUALITY

"What dya mean -no contact maintenance?"

Yes, siree! . . . that's exactly what we mean!

Don't you touch those Allen-Bradley silver alloy contacts with that file. There's no contact maintenance on Allen-Bradley solenoid starters. Why? Because any oxide formed by the arc is as good a conductor as the contact itself. You don't need to clean or file these cadmium silver contacts . . . like you do the old copper contacts. Here's our advice . . . after you install an Allen-Bradley solenoid starter . . . forget it!



Bulletin 709 solenoid starter with arc-hood cover off.

Five Other Advantages of the A-B Solenoid Starter

- **Simple Construction**
  There are fewer moving and wearing parts, assuring trouble-free operation. No bearings or pivots to gum up and corrode. No flexible jumpers to break and cause trouble.
- **Long Life**
  The sturdy rugged construction of all parts assures long life. Millions of operations are built into Allen-Bradley solenoid starters.
- **High Switching Capacity**
  These starters will easily disrupt currents of not less than ten times their maximum horsepower rating—will handle all load conditions.
- **Easy Installation**
  Ample wiring space, accessible terminals, white interiors, and knockouts on all sides and back of cabinet, make wiring easy.
- **Complete Line**
  Available in four standard sizes with a maximum rating of 30 hp, 220 v; 50 hp, 440-550 v. Enclosing cabinets are available for every industrial service condition.

Send for "The Story of the Solenoid Starter"

A-B

Allen-Bradley Co.
1321 S. First Street
Milwaukee, Wisconsin

Please send me a copy of "The Story of the Solenoid Starter."

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CITY_____ STATE_____

ALLEN-BRADLEY
SOLENOID MOTOR CONTROL
QUALITY

THAT WILL SAVE YOU MONEY!

Q. *Is operating efficiency of industrial machinery reduced by vibration transmissions?*

A. Yes—tests have proven actual production increases, delicate settings maintained over longer periods, less adjustments necessary and fewer repairs on a combination of all.

Q. *We have heard that a building may be weakenea by vibration transmission from industrial machinery. Is this true?*

A. Yes—In our experience we have yet to find a plant (including our own) where damage and deterioration cannot be traced to such causes.

Q. *If I should wish to isolate my machines with Unisorb woula (1) the Unisorb be expensive, (2) the installation be expensive, (3) the loss of time due to installation cause production losses?*

A. No—to all three questions. (1) Unisorb is economical because of production, long life, and no upkeep, (2) installation procedure saves in labor costs over old methods, no ripped up floors or hold down bolts, (3) installation can generally be made during non-operating hours and be ready for production when mill starts.

Q. *Are these answers the result of theory and laboratory research or are they the result of actual experience?*

A. These answers are the result of laboratory research, reinforced and affirmed by our own practical experience in isolating a wide variety of industrial machines.

Q. *How can I learn more about Unisorb?*

A. Call or write our engineering department direct (address below) or our branches for a diagnosis of your vibration problem. Ask for our full illustrated booklet showing various Unisorb installations.

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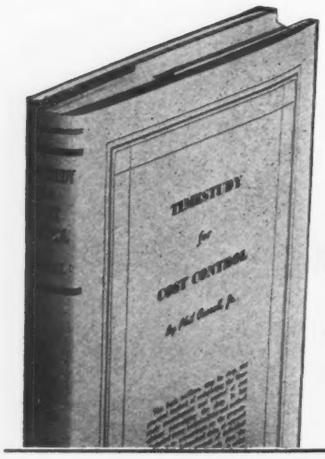

How to make timestudies and how to use them

To lower costs and improve managerial control

JUST PUBLISHED

Timestudy *for* Cost Control

By PHIL CARROLL, JR.
Vice-President, Dyer Engineers, Inc.
305 pages, illustrated, $3.00

THIS book outlines step by step one practical method of completing the timestudy measurement and control of cost without rearranging the shop. It has eliminated many technicalities and method variations to concentrate on the preparation and use of standard data, as opposed to the very costly process of individual operation timestudy. Not only does the method described permit of a much wider field of application, but the author shows wherein it logically extends beyond simple incentive to form the basis for many managerial controls.

You will want to look up in this book

—the fundamental information on the installation of timestudy for cost control;
—the description of the work involved;
—the type of personnel fitted for it, departmental organization;
—the expert information on how to make comparison sheets, how to handle setup time, how to handle variables, etc., etc.
—the application of these methods to many departments of business

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● When you put a Roper Pump in a tough spot, how does it handle the job? In a breeze! Takes it in stride, and produces in a big way!

All pumps bearing the name "Roper" are built with a minimum of working parts and more stamina than is necessary for the vast majority of jobs . . . but when that extra stamina is needed, it's there.

Roper Pumps are smooth performers that operate with the lowest possible power consumption. Easy to install . . .easy to service.

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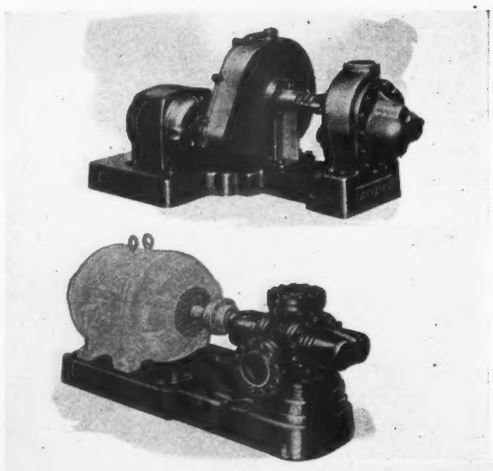

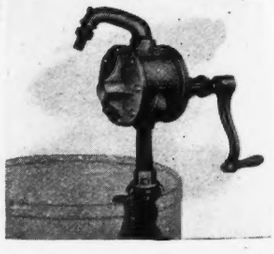

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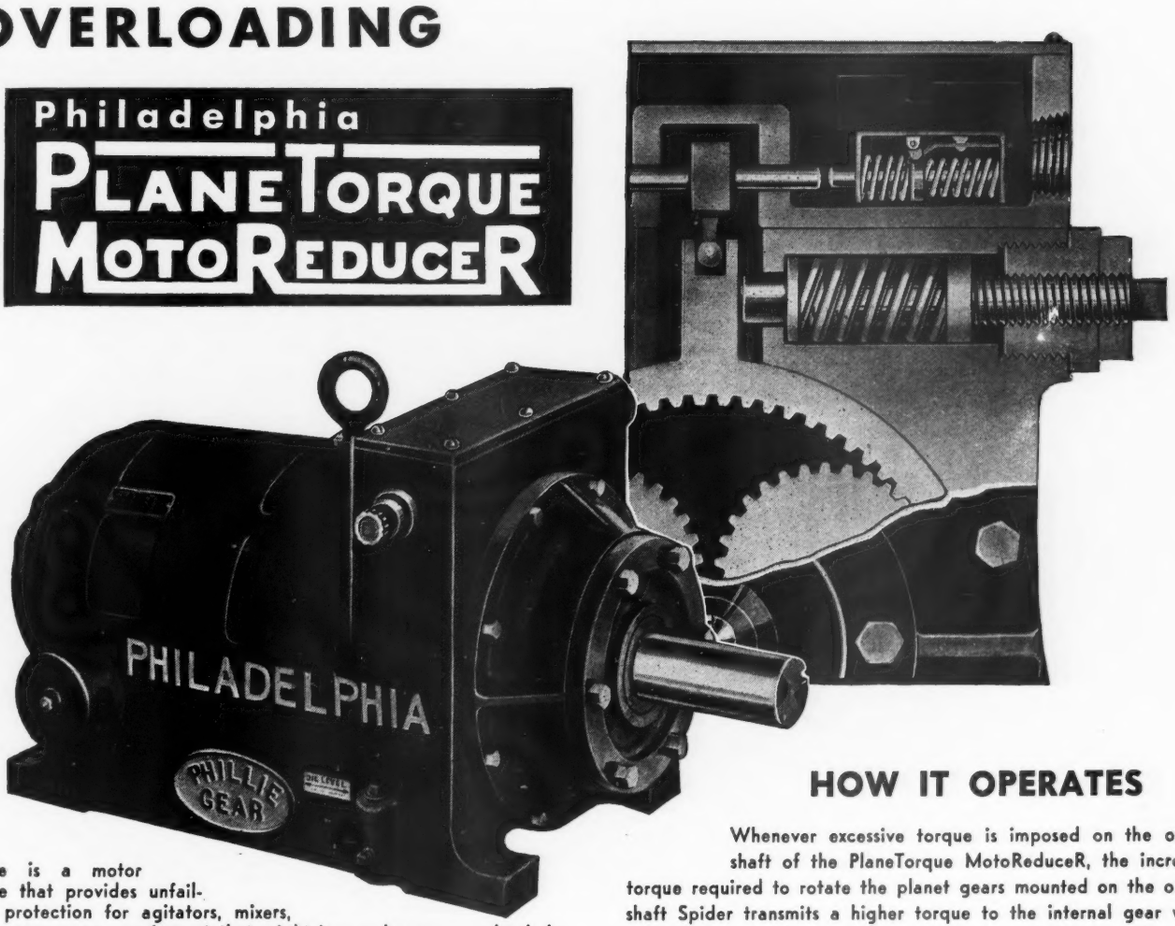
TRADE MARK REG. U.S. PAT. OFF. REG. IN CANADA
Rotary **PUMPS**

DEPENDABLE SINCE 1857

...and now THE NEW DRIVE THAT PROTECTS ALL TYPES OF DRIVEN EQUIPMENT FROM DAMAGE CAUSED BY OVERLOADING

Philadelphia PLANE TORQUE MOTO REDUCER



Here is a motor drive that provides unfailing protection for agitators, mixers, conveyors or any equipment that might jam or become overloaded. The motor is shut off automatically and instantly when the load exceeds a predetermined value. As soon as the excessive load is removed, the unit is ready to start without resetting. It is not necessary to rely upon fuses, thermal overload relays or other devices for protecting equipment from damage caused by loads jamming, catching or becoming excessive. The few seconds required for such devices to function can allow untold damage to occur to expensive machinery and driving mechanism alike. PlaneTorque MotoReduceRs can be supplied for horizontal or vertical drives in all horsepowers and ratios for industrial use.

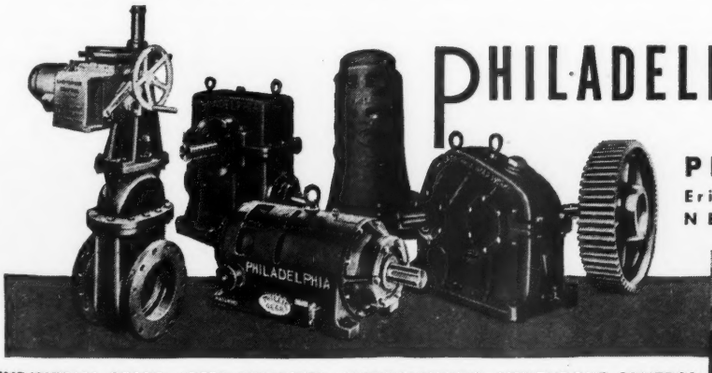
HOW IT OPERATES

Whenever excessive torque is imposed on the output shaft of the PlaneTorque MotoReduceR, the increased torque required to rotate the planet gears mounted on the output shaft Spider transmits a higher torque to the internal gear which is held in normal position by the Lug and heavy spring (see illustration).

When the torque on the internal gear exceeds a predetermined value, the torque spring is compressed. This movement of the Lug actuates the switch at the top disconnecting the power.

These units are furnished for clockwise or counter-clockwise rotation or for both if reversing service is desired.

PlaneTorque can be furnished with all Philadelphia MotoReduceRs



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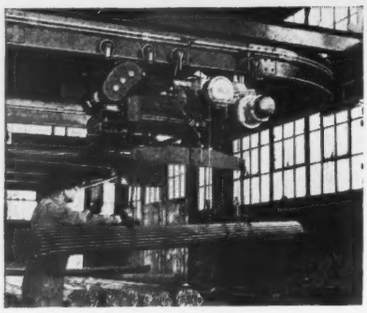
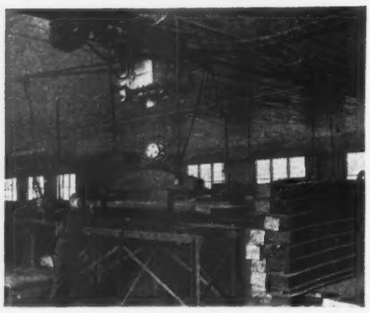


MonoTractor and Hoist on 3-ton RailMaster System.



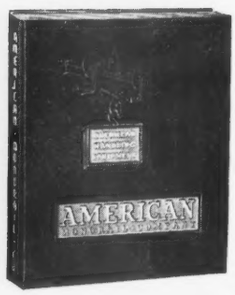
All movement of 3-ton load controlled by push-buttons.

Cab operated cupola charger assures accurate delivery.

Handling adds no value to a product unless it is co-ordinated with production as part of a process or by tying operations closely together.

A system, so designed, eliminates waste, speeds up the pace of production and invariably establishes lower cost records.

American MonoRail engineers apply these principles wherever possible. Extreme flexibility of standard equipment enables them to meet special requirements without extra cost. Engineering service is available at no obligation.



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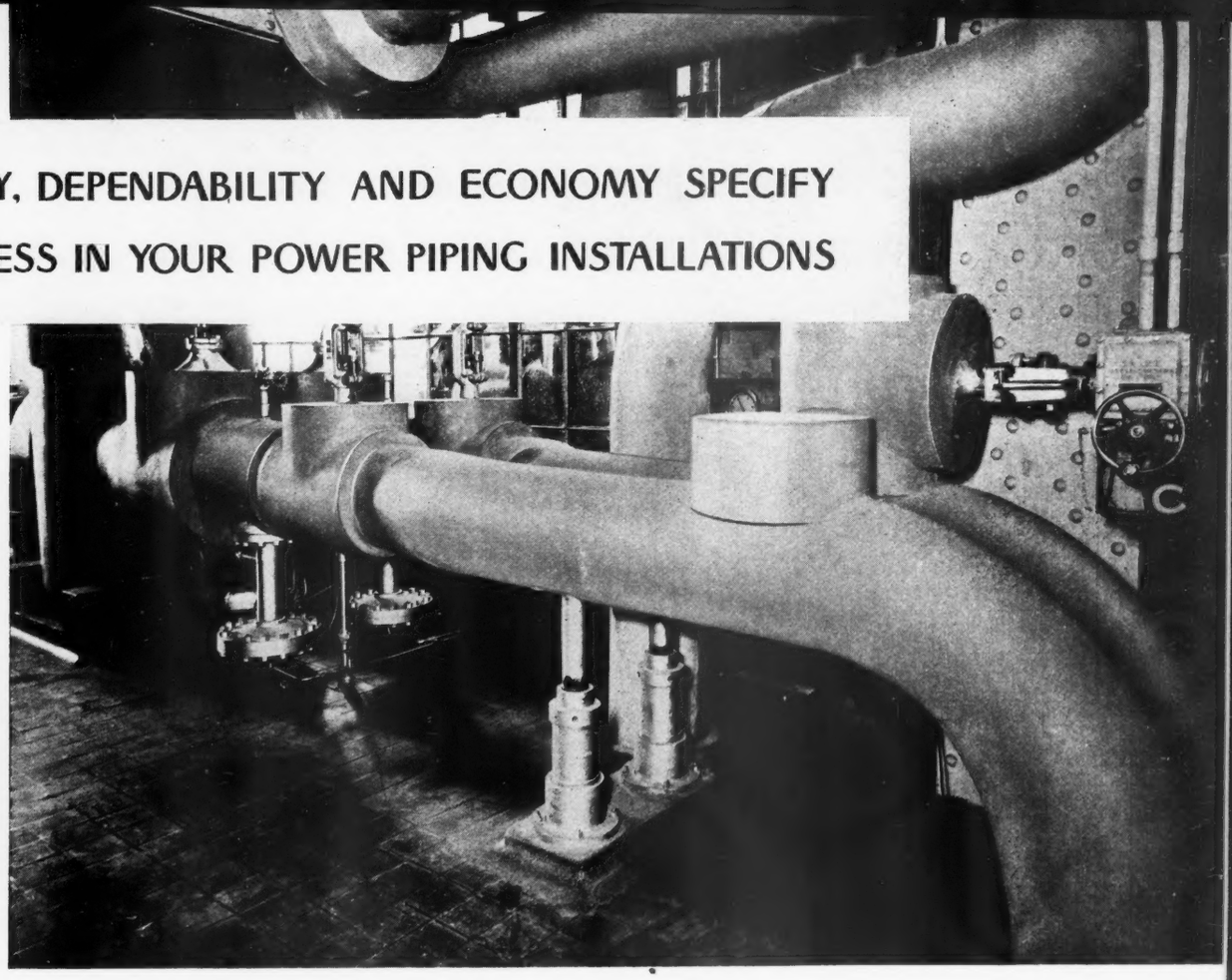
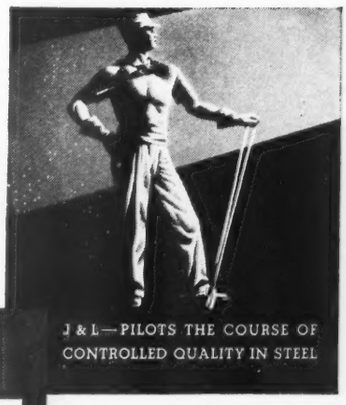


With J & L Seamless Pipe carrying the load, you are sure of the utmost in safety. There can be no failure at or near a weld . . . for there are no welds . . . no weak spots.

Installations in power and manufacturing plants all over the country are proving the merits of J & L Seamless. The piercing and rolling process by which Jones & Laughlin manufactures Seamless Pipe literally rolls extra life and extra strength into every length of J & L Seamless.

Gain the extra advantages . . . the longer life . . . the greater safety . . . that J & L Seamless Pipe gives you.

Make your maintenance dollar go farther. Specify Jones & Laughlin Seamless Pipe for all your power and process needs. Write for a copy of our pipe handbook SP4



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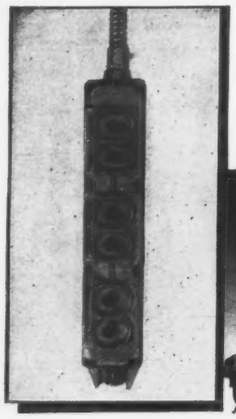
PUSH BUTTON CONTROL

MULTIPLE OR SINGLE SPEED FOR ELECTRIC CRANES AND HOISTS!

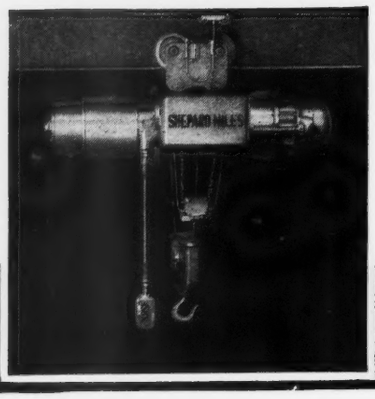


● Shepard Niles multiple speed push button control provides 5 selective speeds by one push button for each travel motion. Each button as it is pressed inward makes five electrical contacts, corresponding to five independent speeds in each direction of travel.

Push button master switch cases are of aluminum alloy and made slender enough to be grasped easily with the hand. An assembly of two or three master switches in tandem can be furnished for the control of 2-motor and 3-motor cranes and hoists. An emergency stop switch is provided at the lower end of the assembly.

Shepard Niles multiple speed push button control for all 6 travel motions applied to 3-motor electric traveling crane.

Shepard Niles LiftAbout equipped with single speed push button control.

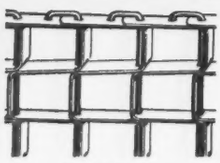


A COMPLETE LINE OF CRANES & HOISTS

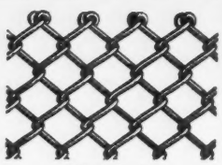
SHEPARD NILES CRANE & HOIST CORP.

364 SCHUYLER AVENUE... MONTOUR FALLS, N. Y.

HOW COSTS WERE CUT IN MANY PLANTS



U·S·S Cyclone FLAT Conveyor Belt



U·S·S Cyclone CHAIN LINK Conveyor Belt

THESE belts save money. They speed production, eliminate repairs, save labor. U·S·S Cyclone Metal Conveyor Belts come in two types: Flat Wire and Chain Link. They can be built to suit your particular requirements.

Ideal for sack, package, box and can-carriers, sorting tables, drying ovens, scalders and washers, carriers for fruits, vegetables, tobacco, fish, etc.

Not affected by heat, or cold, steam, water, changes in temperature or any of the usual causes of conveyor belt trouble. Get the facts and prices—no obligation.

USS **CYCLONE**

Metal Conveyor Belts

CYCLONE FENCE COMPANY, *Waukegan, Illinois*
Dept. 979

UNITED STATES STEEL

THIS HYDRAULIC GAUGE WITHSTANDS SHOCK LOADS

Simple "direct-action" construction requiring no gears nor other delicate parts, gives Schrader Gauges their exceptional ruggedness. For all types of hydraulic power. Used to replace present installations and also for original equipment. Nine standard gauges ranging in pressure from 5 to 5,000 pounds. Specify Schrader Hydraulic Pressure Gauges.

Send for Catalog No. 305 which describes the Schrader Hydraulic Pressure Gauge and the complete line of Schrader Air Accessories.

Schrader
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A. SCHRADER'S SON **Dept. FMM** BROOKLYN, N. Y.
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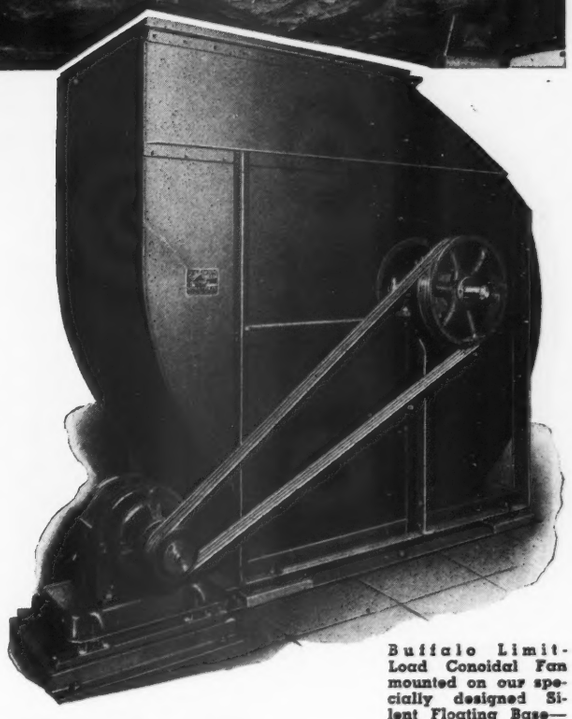
21 Worlds Fair Exhibits are more comfortable ... thanks to "Buffalo" EQUIPMENT

Seventy-one Buffalo Fans and much other Buffalo Equipment such as Air Conditioning Cabinets and Air Washers are helping to make "Weather to Order" in some of the finest exhibits at the New York World's Fair.

This equipment was purchased at regular prices by exhibitors and their engineers who insisted on having equipment they knew to be absolutely dependable.

If you have an air handling problem whether it be small volume at high pressure, or large volume at low pressure, or any combination of these, we have the experience and ability to solve your problem efficiently, economically, and to your complete satisfaction.

We solicit your inquiries on the basis that we are well qualified to give you what you need and want.



Buffalo Limit-Load Conoidal Fan mounted on our specially designed Silent Floating Base—another reason why Buffalo Fans rank so high in quiet, efficient, low-cost performance.

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"Buffalo" **FANS**

and AIR CONDITIONING EQUIPMENT for EVERY COMMERCIAL and INDUSTRIAL NEED

Practical

INDUSTRIAL RELATIONS may well begin with these 5 easy steps

Tangible, everyday things that make their working conditions more comfortable, that help your people turn out a better product—that's what *practical* "industrial relations" mean to them.

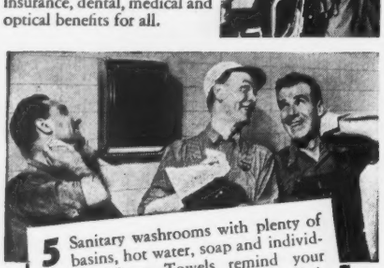
Here are five simple, tested suggestions that have been successful with others. Everyday builders of good will —they can help the people who work with you have more respect for themselves, their jobs and their company.

1 Where work is hot or dusty, modern showers build real good will. Add soap, hot water, towels and a pan of 10% solution of thiosulphate to prevent athlete's foot.

2 For better work, happier workers, the height and angle of each chair, bench or machine should be scientifically adjusted to minimize fatigue and strain.

3 High spot of anyone's year is vacation. Thoughtful management helps both salary and wage employees budget soundly for this necessary and enjoyable period.

4 A Beneficial Association to which all workers contribute small amounts helps provide adequate group insurance, dental, medical and optical benefits for all.



5 Sanitary washrooms with plenty of basins, hot water, soap and individual ScotTissue Towels remind your people daily of your interest in their comfort, health and well-being.

The Scott Washroom Advisory Service is available to help arrange washrooms comfortably, economically and efficiently. The Scott Survey will suggest how to relieve congestion, reduce waste, overhead expense, and create good will in your washrooms.

• Scott Paper Co., Chester, Pa. Send me, without obligation, your booklet, "Scott Washroom Advisory Service."

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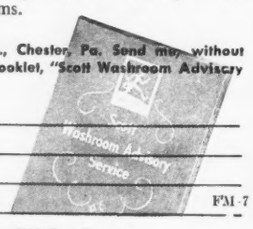

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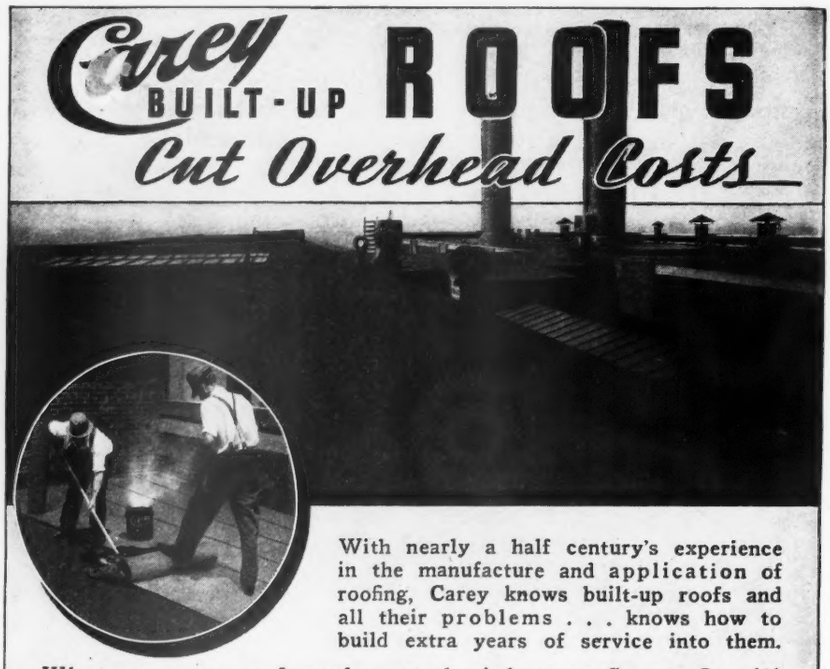
Carey BUILT-UP ROOFS *Cut Overhead Costs*



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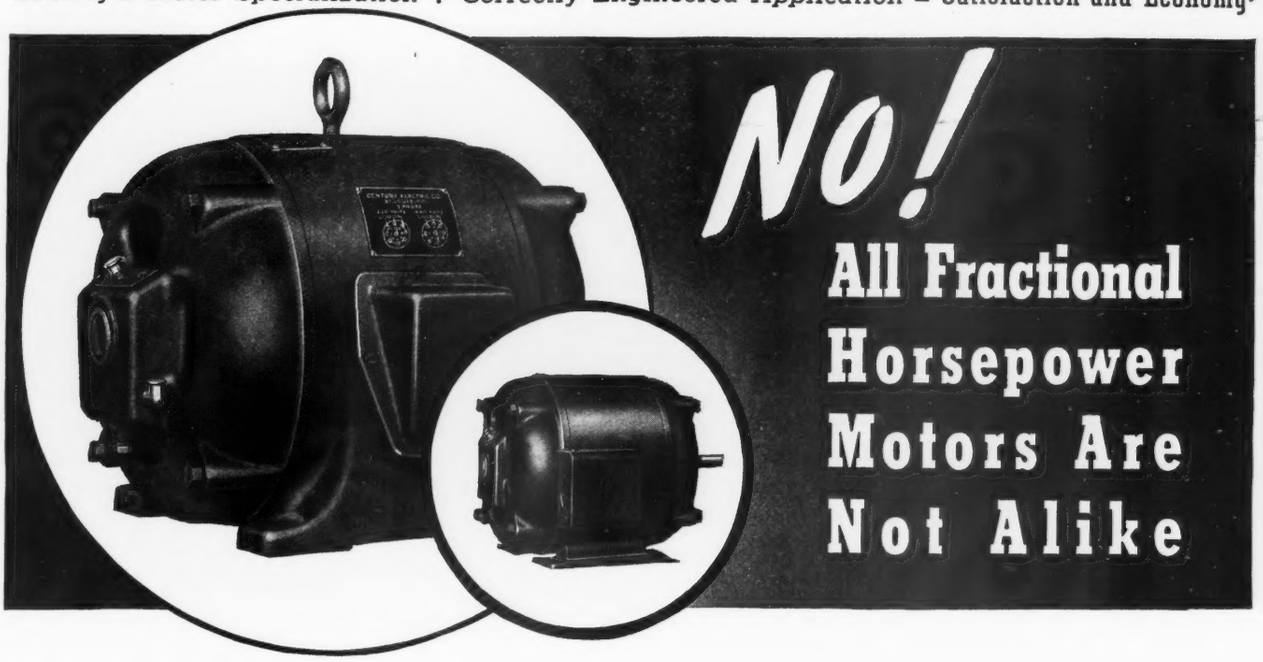

THERE is a wide difference between the ordinary fractional horsepower motors and Century *small size industrial motors.*

Century small size industrial motors are built to the same high electrical and mechanical standards incorporated in large integral size industrial power motors.

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These heavy duty, long life features result from sleeve bearings machined from phosphor bronze castings, diamond bored for accuracy of roundness.

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Century general purpose stock motors have gained an enviable reputation for being remarkably free from vibration.

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Saturating the windings with insulating compounds functions two ways—(1) seals surfaces and crevices between turns; prevents magnetic vibration of turns and breakdowns from chafing—(2) resists abrasives, moisture, oil, mild acids and mild alkalies.

These important features substantially prevent electrical breakdowns, assure longer life and reduce production shut-downs.

Self Cleaning—Mechanical ventilation—air passages between the frame and field laminations act to carry away heat and at the same time blow dirt through the motor.

The highest quality is built into every Century Motor *regardless of size.* That's why in thousands of plants, Century *industrial motors* are depended upon for uninterrupted production.

There's a Century Motor Specialist near you who will gladly help determine the correct motor application for any particular job. His many years of experience in the correct application of electric power are always at your service. Call him.

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Prevents Adhesion of Weld Spatter, Prevents Corrosion

Sample lap weld treated with Glyptal No. 1294 Gray before arc welding. Note the spatter-free surfaces adjacent to the weld. Overlapped edges are protected against corrosion

Typical fillet weld on plates not protected by Glyptal No. 1294. Note the weld spatter that must be chipped off before finishing

APPLICATIONS

This new coating compound is now available in two varieties:

Glyptal No. 1294 Clear—Prevents adhesion of weld spatter and resists corrosion of steel in storage.

Glyptal No. 1294 Gray—Provides all the advantages of the clear variety. In addition, it prevents corrosion of surfaces inaccessible after welding, such as the overlapping edges of a lap joint. It can also be used with resistance welding.

ADVANTAGES

The use of either variety saves practically all the time otherwise required for cleaning weld spatter from surfaces which are to be finished. A single coating serves for both singlepass and multipass welds. It need not be removed after welding—in fact, it serves as an excellent base or primer for paint. Either variety can be sprayed or brushed—coverage per gallon is approximately 500 square feet for the clear and 400 square feet for the gray. Neither causes injurious fumes or smoke to form on the welder's glass. Neither causes porosity or carbon to injure the ductility of the weld.

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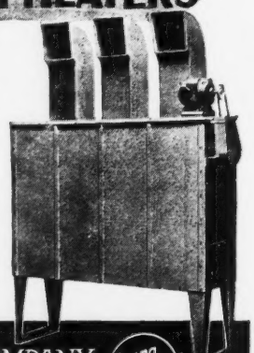

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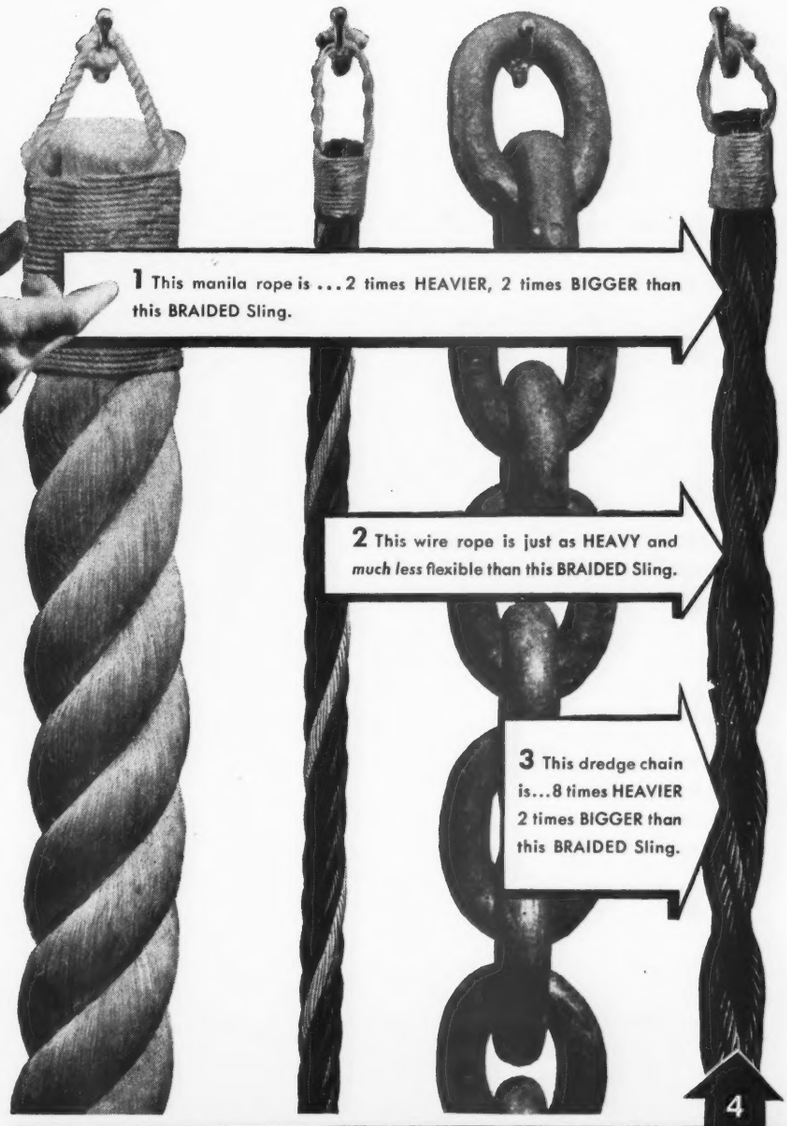
1 This manila rope is ... 2 times HEAVIER, 2 times BIGGER than this BRAIDED Sling.
2 This wire rope is just as HEAVY and much less flexible than this BRAIDED Sling.
3 This dredge chain is...8 times HEAVIER 2 times BIGGER than this BRAIDED Sling.
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RECOMMENDATIONS:

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OVERALL DIAM.	3"	7/8"	3¼"	1-3/8"
WEIGHT PER FT.	2.42 lbs	1.23 lbs.	10.65 lbs.	1.28 lbs.
STRENGTH	30.5 tons	32.2 tons	31.0 tons	32.4 tons

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Camden, N. J. factory of Congress Cigar Co., manufacturer of the famous La Palina.

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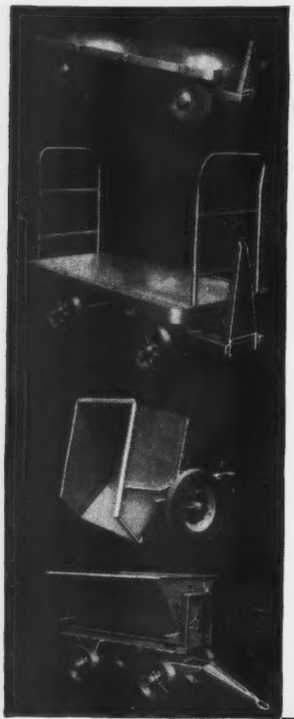

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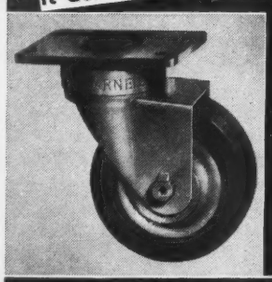

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5 **The Pipe Line that Moves Materials** —Descriptive booklet on the Johns Conveyor, which conveys wet or dry and granulated materials horizontally, vertically, and obliquely by means of a large moving rubber hose split longitudinally throughout its length for the purpose of receiving and discharging its load. Catalog J-1. **Johns Conveyor Div., Osborn Mfg. Co.**

6 **Metal Conveyor Belts** — 12-page catalog illustrates and describes two different types, Chain Link and Flat Wire. Explains their application to various materials handling and processing tasks. Pulleys, drives, one-way weave and right-and-left hand alternating weave also discussed. **Cyclone Fence Co.**

7 **Complete Data on Conveyor Belting** —For full information consult pages 3, 4, & 8 of Thermoid's catalog on Industrial Rubber Products. A complete line of belting, hose, packings, and brake linings are also described in the same catalog. **Thermoid Rubber Division of Thermoid Company.**

8 **Dust-Tight Sealmaster Pillow Blocks, Flange, and Take-Up Units**—Informative bulletin describes how actual operating tests, under severe dust, grit and other difficult conditions, have proved this new self-aligning sealed bearing protects itself from damage by foreign material. Especially recommended for conveyors. Data includes load capacities, dimensions, and complete specifications. **Stephens-Adamson Mfg. Co.**

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9 **Crane and Shovel Catalogs** — A series of well-illustrated bulletins describing locomotive, truck, crawler, and wagon cranes and power shovels adaptable to all types of materials handling and building excavating problems. Includes detailed technical data on capacities and clearances. Contains helpful information on how to select the proper equipment for many types of materials handling jobs. **The Browning Crane & Shovel Company.**

10 **15 to 50 Ton Diesel Locomotive Cranes**—Profusely illustrated booklet on popular-sized machines. Describes application to materials handling work and switching service in many lines of industry. Shows construction features and details. Contains capacity and clearance dimension tables. **Industrial Brownhoist Corp.**

11 **Solving Handling Problems** — 48-page book presents pictorially many solutions to industrial handling problems. Details and illustrations of equipment construction are included in a book that shows practical applications of materials handling in many diversified industries. **American Monorail Co.**

12 **Wire Rope Slings** — Two booklets containing over 70 "on-the-job" photos . . . "How to Handle Loads Safely" and "Safe Handling" . . . illustrate safe practice in handling many types, sizes, and shapes of loads with braided wire rope slings. These booklets show how leading manufacturers are solving materials handling problems speedily, safely, economically. **Macwhyte Company.**

HOISTS

13 **Lo-Hed Hoists** — Complete catalog describing hoists of many different sizes and capacities, as well as supplementary bulletins giving technical data and specifications sheets for each type of hoist. All material has been prepared so that plant men can easily specify the hoist best suited to their needs. **American Engineering Company.**

14 **Electric Hoists**—Bulletin 138 points out the low operating cost and describes in detail the many features of the new "Comet" electric hoist that can be plugged into either a single-phase lighting circuit or a three-phase power line. Available in 4 capacities from 250 lbs. to 1,000 lbs. **Chisholm-Moore Hoist Corp.**

15 **Electric Hoists and Trav-Lift Cranes** —2 well-illustrated catalogs describing a complete line of electric hoists, cranes and trolley hoists adaptable to all kinds of materials handling problems. Including complete performance data, clearances, and action pictures indicating how various hoists and cranes can be adapted to handling problems of all industries. **Harnischfeger Corp.**

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POWER TRUCKS, TRACTORS, TRAILERS, BATTERIES

19 **Trucks—Tractors—Cranes** — Data and Bulletins on Modern Intra-Plant Transportation Equipment—Now available on a complete line of electric trucks—capacities up to 60,000 lbs. covering low and high lift, fork and ram type; tractors and cranes. Also trucks of special design. Equipment is fully illustrated with dimensions; capacities; and general constructional specifications. **Automatic Transportation Company.**

20 **Industrial Trucks, Tractors, and Cranes**—New general catalog No. 50 illustrates all types of trucks, tractors and cranes showing many applications and providing complete information on capacities and operating characteristics. Also bulletin on new center-control fork and ram trucks. **Baker Industrial Truck Div. Baker-Raulang Co.**

21 **Trucks, Tractors and Cranes** — Abridged pocket-size 32-page catalog shows leading types of trucks, tractors and cranes. Clearly illustrated showing mechanical details as well as specifications and available power. Illustrates and describes the company's complete system of industrial transportation. Designed to help the plant man decide the type of equipment best suited to his own product. **The Elwell-Parker Electric Company.**

22 **Industrial Trucks and Tractors**—One descriptive bulletin illustrating industrial applications of small triple powered tractor especially well adapted for use in factory material movement jobs. Tells how power is available at draw bar, belt, and power take-off. Another illustrated booklet describes full line of trucks consisting of 42 basic models in 142 different wheelbases ranging in capacity from light pick-up units to the largest six wheeler types with gross weight of 62,000 lbs. **International Harvester Co.**

23 **Tractor Trailer and Lift Truck Equipment**—A complete binder of literature on latest types of electric and gasoline tractors, industrial trailers and elevating platform and fork and ram type trucks. Each bulletin furnishes detailed information on a specific type. Together they provide a ready reference volume on materials handling equipment. **Mercury Manufacturing Company.**

24 **Industrial Trailers**—Series of bulletins describing a wide range of industrial trailers adaptable for all types of materials handling. Well illustrated, describing trailers ranging in capacities from 1 to 10 tons with platforms or dump bodies, and with either pneumatic or solid tires. Bulletins A600A—B—C—D. **Electric Wheel Co.**

25 **Industrial Truck Batteries**—Folder describing briefly new type Exide-Ironclad Battery for modern industrial trucks 20,000 to 30,000 pounds capacity. Of particular interest to men in plants where large size, high load capacity electric trucks are used. **The Electric Storage Battery Company.**

HAND, FLOOR AND LIFT TRUCKS

26 **Light Weight Pressed Steel Channel Factory Trucks and Platforms**—Bulletin describes new smooth deck all steel factory truck using special pressed steel channels for light weight and rigidity. Bulletin also describes steel weld platforms for use with Clark lift jacks. Shows how trucks and platforms are fabricated without bolts, nuts or rivets for light weight and strength. **All Steel Welded Truck Corp.**

27 **Industrial Hand Trucks, Wheels, Barrel and Carboy Trucks and Stands**—Catalog T-39. Profusely illustrated 16-page catalog and price list, describing a complete line of trucks designed for trouble free service. A valuable catalog to help in the selection of proper type trucks to meet individual industrial requirements. **American Pulley Co.**

28 **Materials Handling**—Three booklets, L-253, L-257, L-261, and catalog L-222R describing in detail hand trucks, platform trucks and barrel handling trucks and accessories designed to facilitate storing, shifting and loading of raw materials and finished goods Well illustrated. **The Colson Corp.**

29 **Hand and Platform Trucks, Casters, Wheelbarrows**—Complete 110-page catalog having all types of hand trucks, platform and special purpose trucks and wheelbarrows. Every model well illustrated and catalog also describes complete line of wheels and bearings, as well as helpful maintenance data. **The Fairbanks Company.**

30 **Steel Floor Trucks**—Bulletin, Form 526, fully illustrated, shows line of steel floor trucks for use in handling of materials. Complete information is given with regard to models, sizes and prices. **Standard Pressed Steel Co.**

31 **Combination Platform and Hand Truck** — Bulletin describing combination Jack and Skid Platform especially adaptable to handling materials in close quarters. Describes automatic loading feature and tells how loads can be eased to the floor under complete control. **The Yale & Towne Mfg. Co.**

TRUCK CASTERS AND WHEELS

32 **Truck Casters and Industrial Truck Wheels**—Catalog No. 120 contains 48 pages of useful information on sizes and types of truck casters and industrial truck wheels applicable to all types of trucks and portable equipment. Complete specifications, load capacities, etc. are given, making this catalog a useful reference book for the selection of proper casters. **The Bassick Co.**

33 **Caster and Wheel Manual**—A 192-page manual, completely illustrated, giving every possible sort of information desired by users of casters, glides, or wheels. The widest range of sizes and types of casters and wheels is offered. **Darnell Corporation, Ltd.**

34 **Caster and Wheel Manual for Trucks, Assembly Lines, etc.** — Detailed specifications and complete engineering data for users of casters and wheels given in Industrial Caster Manual. Complete variety of plate and swivel casters with composition, semi-steel and rubber tired wheels illustrated and listed in simplified form. Facilitates selection to fit specific requirements. **Faultless Caster Corp.**

SHOP BOXES AND SKIDS

35 **Shop Box Catalog**—Booklet showing how time, money and space can be saved through the use of steel boxes in handling materials in process and in storage areas. Shows a wide variety of steel box styles and sizes. Tells how shop boxes facilitate handling and increase accessibility. **Lyon Metal Products, Inc.**

36 **Skid Boxes, Trays, and Box Trucks**—Catalog and illustrated folder showing construction, size, prices, and uses of resilient woven wood-and-wire stacking skid boxes, trays, and box trucks. **G. B. Lewis Co.**

PACKAGING AND SHIPPING

37 **"Stopping Profit Leaks Beyond the Production Line"**—New, well-illustrated 24-page booklet showing how packing and shipping costs have been reduced by shippers in every industry. Tells how to avoid unnecessary costs, eliminate damage and cut freight bills. Complete, concise and to the point, the booklet tells how to locate losses . . . after production. **Acme Steel Co.**

This card must be filled out completely in order to secure the literature you request. Please circle only those bulletins in which you are particularly interested.

FACTORY MANAGEMENT and MAINTENANCE

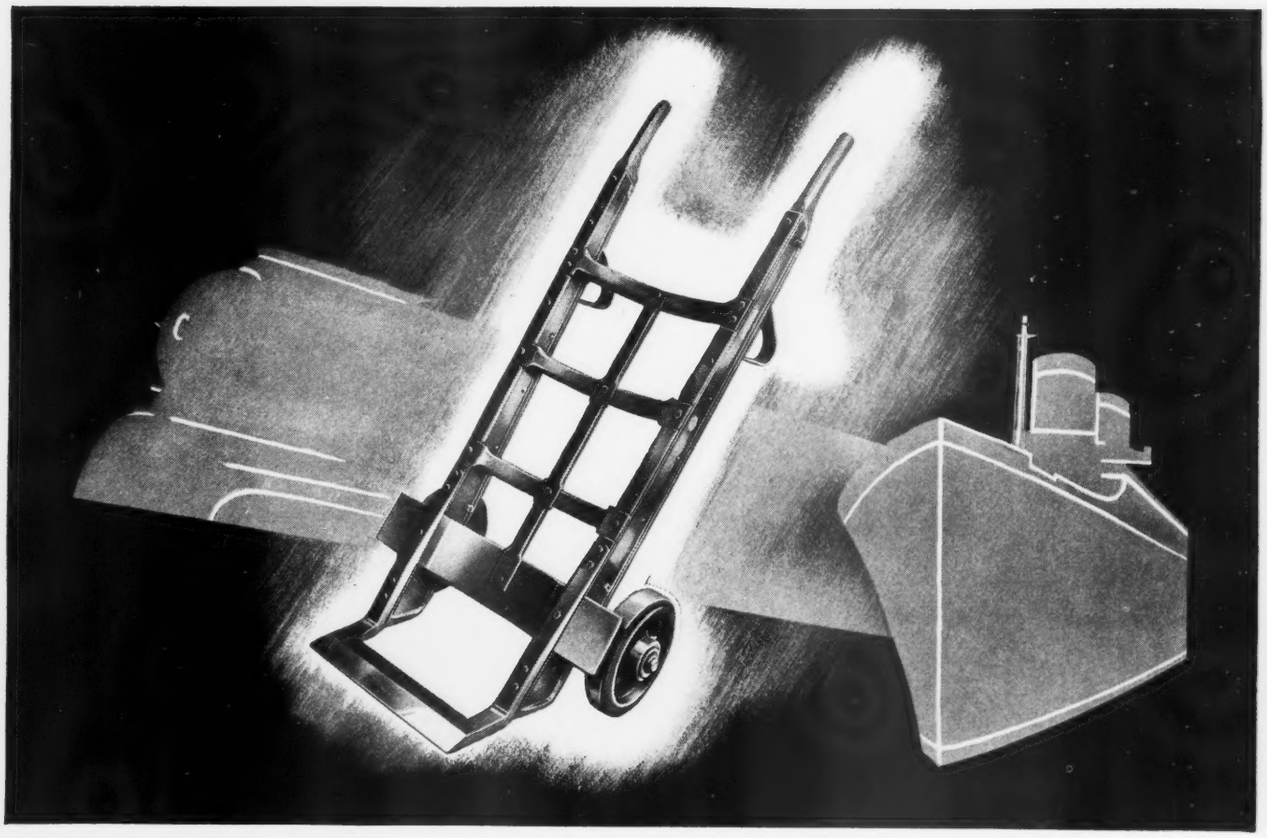
Please have the manufacturers send me, without obligation, the literature circled below. (Numbers correspond to descriptive paragraph numbers.)

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____



TRANS-CONTINENTAL . . . OR TRANS-OCEANIC "AMERICAN" PRESSED-STEEL TRUCKS ARE THE LEADING CHOICE OF LEADING SHIPPERS

The same features which have made these trucks the choice of leading steamship companies and railroads will make them a profitable investment for you.

Exhaustive, practical studies were made *right where shipping is done.* Then, from these studies, designs and structural features were developed to meet the specific problems.

Regardless of the character of the materials you are moving, or the working conditions, there is an "American" Pressed-Steel Truck that will give you superior service and longer life. See your dealer today, or write for catalog.

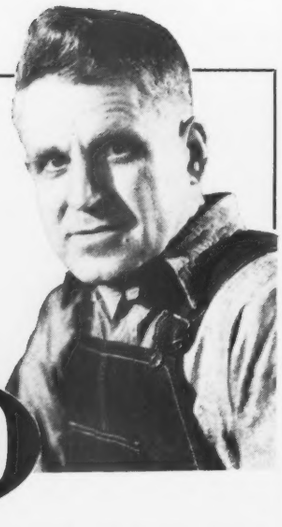
These features make "Americans" the best obtainable

- You get more material moved with the same effort—correct balance relieves trucker of dead weight.
- These trucks are practically unbreakable because of sturdy pressed-steel construction.
- There is a truck ideally suited for your particular requirements. Complete line includes 34 styles and 75 sizes.
- Roller bearings and rubber-tired wheels cost little extra—speed up operations and save flooring.

THE AMERICAN PULLEY CO., Dept. 2, 4200 Wissahickon Ave., Philadelphia, Pa.

AMERICAN PRESSED STEEL HAND TRUCKS

Machinery Maintenance is a Cinch, Now We're Using the Set Screws with "The Third Factor"



UNBRAKO

SELF-LOCKING HOLLOW SET SCREWS

with the knurled points are

1—Strong 2—Accurate and 3—Won't Shake Loose

Fig. 1641
Pat. Applied For

The mechanics and maintenance men who have used "Unbrako" Self-Locking Set Screws know that once they are set up with only normal pressure, they positively stay put. No need for continual check-ups . . . and no danger of the accidents or machinery breakdowns that can follow ordinary set screws failing to hold tight. The ingenious knurling around the cup point locks them in place . . . yet removal can be made with an ordinary hex bar wrench whenever machine adjustments are necessary and the screws used over again many times. Take no chances — specify "Unbrako" Self-Lockers . . . send for samples and literature today.

Fig. 1645
Pat. Applied For

Fig. 1646
Pat. App. For

UNBRAKO

SQUARE HEAD SET SCREWS

have this protection feature too

Our Square Head Set Screws, known and liked throughout industry for years can now be furnished with the knurled self-locking points. Safety added to quality gives them undeniable superiority.

STANDARD PRESSED STEEL CO.

BRANCHES
BOSTON
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JENKINTOWN, PENNA.
Box 546

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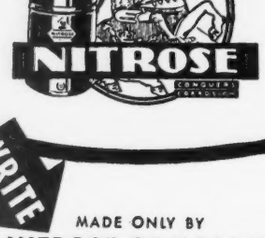
NITROSE

the time proved corrosion resisting coating for metal surfaces. Gives longer, more complete protection at substantial savings in preparatory and application costs. Our representative will be glad to make estimates and recommendations.



WRITE

MADE ONLY BY
THE NITROSE COMPANY, INC.
PEORIA, ILL., U. S. A.

An Aid to Safety!

Safe floors are a major consideration—as they should be—and two of the major requirements for safe floors are cleanliness and sanitation.

Here is a heavy duty Finnell designed expressly for the industrial industry,—for hard-to-clean floors, floors embedded with heavy coatings of dirt, oil, grease, or steel shavings. Its two scarifying brushes literally *dig* out the dirt!

Brush rings are removable—may be replaced with tampico or palmetto brushes and used for scrubbing, steel-wooling, waxing, or polishing floors.

FREE DEMONSTRATION
Phone nearest branch, or write:

FINNELL SYSTEM, Inc.
2507 East Street Elkhart, Indiana

AIR FILTRATION AAF DUST CONTROL

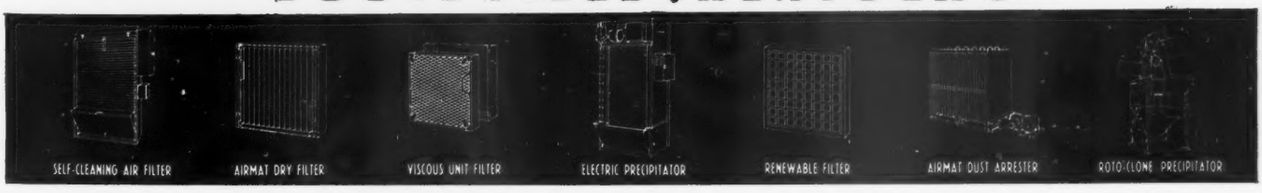
THE SYMBOL of *Clean* AIR

There are a few manufacturers whose names or trademarks are more than just a means of product identification—they have become thru years of public acceptance—symbols of quality and value. » » » Some of these names are by-words to the man-on-the-street—but less familiar to the vast public are those companies which have indirectly contributed to consumer acceptance of the Nation's greatest products. Among this latter group is—AAF—the Symbol of Clean Air—pre-eminent in the field of Dust Engineering. » » » Pioneers in this highly specialized field, AAF engineers for the past 19 years have concentrated their efforts exclusively to the development of practical air cleaning equipment. » » » Today this equipment is in general use in every field of American manufacture—reducing operating costs, eliminating dust hazards—accelerating production and protecting quality. » » » Because AAF products have exceeded in performance the promises made for them, and because they have so consistently contributed to earnings thru actual savings, the AAF symbol is accepted today as the Standard by which Dust Control equipment is judged. » » » Now in the spotlight of industrial favor, AAF symbolizes the greatest engineering achievements in Air Filtration and Dust Control. Write for one or all of the booklets illustrated . . . they tell the story of the Conquest of Dust—Please address your inquiry to 304 Central Avenue.

AMERICAN AIR FILTER CO., INC.

INCORPORATED

LOUISVILLE, KENTUCKY



Regular Food Service for Greater EFFICIENCY

● In mass production operations, regular food service on the job is an important factor in maintaining workers' efficiency. Both employers and employees benefit from increased production.

With Ideal food conveyors you can provide highly satisfactory periodic food distribution throughout the factory at minimum cost.

In the Ideal line is a wide range of available models designed to purvey either simple or elaborate offerings . . . from simple hamburgers, sandwiches, pastry, coffee, milk, candies, tobacco, etc. to a full cafeteria menu including also hot sandwiches, soups, stews and chilled desserts.

Ideal Conveyor Model No. C-877-C shown above is 62" high, 35½" wide and 56" long. It has a body of sturdy 18-gauge steel and a serving deck and drop shelf of stainless steel . . . plate glass in display section . . . glass wool insulation. Refrigeration compartment maintains temperature of 33°, the heated compartment 180°. In addition to 154 variations of standard models, Swartzbaugh also offers custom designed equipment.

THE SWARTZBAUGH MFG. CO.

TOLEDO, OHIO

Associate distributors: The Colson Corp., Elyria, O.; The Colson Equipment and Supply Co., Los Angeles, San Francisco; The Canadian Fairbanks-Morse Co., Canada.

Mail this coupon for a free copy of the interesting booklet "Human Beings at Work."

The Swartzbaugh Mfg. Co., Toledo, Ohio
Please send me free copy of "Human Beings at Work."

Name _____

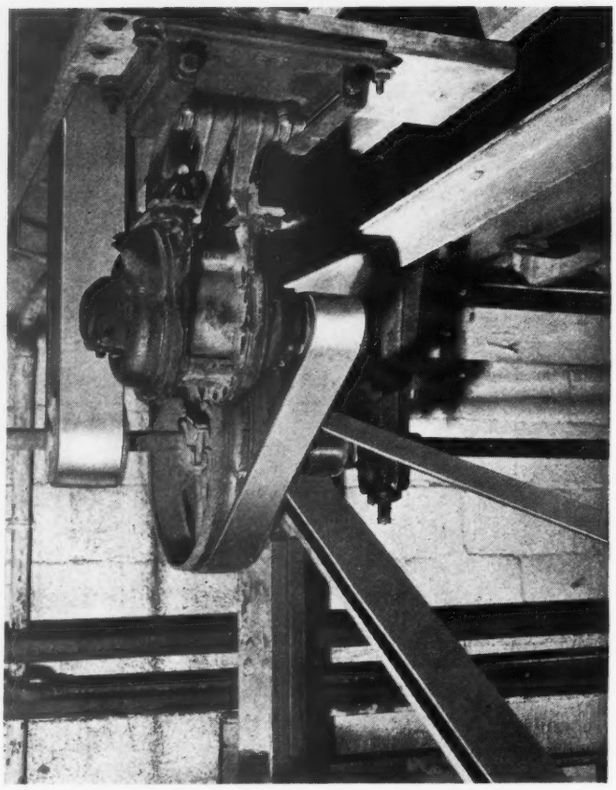
Firm _____

Address _____

City _____ State _____

60%

INCREASE IN PRODUCTION with TANNATE LEATHER BELTING!



TANNATE Belt pays for itself in three months on group drive!

It is not unusual, but it is an interesting case: On a motor driving shaft—which, in turn, drives a cinder block tamping machine and a cart hauling rope drive—an 8′ 11″ long TANNATE Belt replaced a long center drive rubber belt.

First result was a notable absence of slippage which badly impaired efficiency of the rubber belt drive; TANNATE gripped surely.

Secondly, it was soon found that TANNATE stepped-up production by 60% . . . an increase that paid for the belt in 3 months and now shows as clear profit!

Further, when replacement is necessary, a decided additional saving will be made because of the shorter belt length required! With TANNATE, the drive runs on a 30″ center, where previously 8″ to 10″ centers were necessary!

Can you use performance like this?

J. E. RHOADS & SONS

Established 1702

35 N. SIXTH ST., PHILADELPHIA, PA.

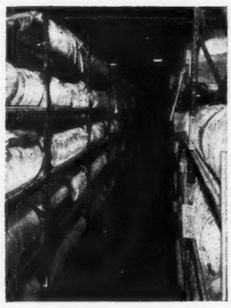
NEW YORK CHICAGO ATLANTA CLEVELAND

FACTORY AND TANNERY AT WILMINGTON, DELAWARE

HERE'S HOW

July ★ News About New Developments in Storage and Shop Equipment ★ 1939

Glass Sign Manufacturer Cuts Storage Space 87½%

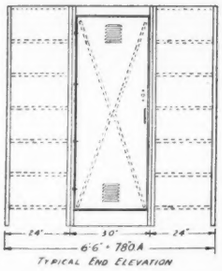


Before Lyon engineers were called in, the circular glass signs shown in the accompanying illustration were stored in boxes, 12 to 18 per box. The boxes could not be stacked many tiers high because the many different types of signs, used for advertising purposes in the top of gasoline pumps, were dispensed one or two at a time. Lyon commercial tire racks, with strips of plywood bolted onto the face of the tire bars to protect the signs from direct contact with the steel, enabled this manufacturer to speed up storage and dispensing of signs tremendously, while reducing storage space requirements to 12½% of that used previously.

Industry Welcomes Showerway

Because it saves steps and time for office and factory workers, at the same time reducing the hazards of communicable disease, this new mobile self-contained lavatory fixture has attracted widespread interest among industrial plant executives. Showerway provides a thorough sanitary hand wash in 15 seconds. A slight pressure of the foot pedal showers warm water down on the hands, which touch only the soap plunger. There are no drain plugs. Water runs away as used, its showering action keeping the bowl clean.

Special Archive Storage with Lyon Standard Shelving



The adaptability of Lyon Steel Shelving to unusual storage requirements is well illustrated by its use for archive storage in a Pittsburgh office building. Original plans specified wood partitions, to be covered with wood sheathing, providing individual cubicles that could be locked securely. But the same layout was secured, with the added advantages of steel construction, and the economy of standard parts, by the simple expedient of putting racks of Lyon Steel Shelving face-to-face, covering the overhead space between them with a special steel plate, and suspending steel doors on the racks, as shown by accompanying diagram of end elevation.

Lyon Steel Shop Boxes Help Industry Cut Materials Handling Costs

Shop boxes form the basis upon which many production systems are built. And practical tests demonstrate that properly designed steel shop boxes, while slightly higher in first cost, provide easy handling, quick accessibility to contents, savings in shelf or floor area, and extra years of repair-free service that pay big dividends.

The experience of an eastern manufacturer of electrical household appliances provides a typical example. Parts going through the various operations were originally handled in wooden boxes of about sixteen cubic feet capacity, built to carry loads as high as 3,000 pounds.

Floor Space Saved—Repair Cost Eliminated

Handling and storing these necessarily bulky wooden boxes, as well as the heavy cost of keeping them in usable condition, presented so serious a problem, that the manufacturer decided to make a one year comparative test of wood and steel boxes.

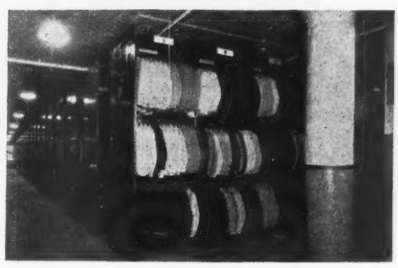
At the end of the test, all wood boxes were discarded and replaced with Lyon Steel Boxes. "In the first place," said the executive of the company, "we found that we could stack the sturdy Lyon Steel Boxes three high, which made it possible to store three times as much stock on the same floor space... relieving a serious congestion in the stockroom which was actually interfering with production. Furthermore, the elimination of the constant replacement and repair expense has made these steel boxes a most profitable investment."

Just what savings in replacement and repair can represent is illustrated graphically by the records of a manufacturer of photographic supplies. In this manufacturer's plant the average life of wood shop boxes, with frequent time out for repairs, was three years. Lyon Steel Shop Boxes used on the same work and under the same conditions have been in continuous service for twelve years with practically no expense for maintenance.

What's New?

Built on a mass production basis, with tools originally made for producing Lyon Lockers, this sturdy steel cabinet—ideal for safe storage of office supplies, factory records, etc.—is offered at the unusually low price of $18.75, f. o. b. factory. Available in 1-shelf wardrobe and 4-shelf cabinet models. Shipping weight, 133 pounds.

Flexible Storage for Suits and Overcoats



A clothing manufacturer, with seasonal peaks in the production of suits and overcoats, required storage equipment so flexible and adjustable that it could be quickly adapted to either type of garment. The problem was solved with Lyon standard units, equipped with a special clip and hanging rod which provided the adjustment required. The paneled rack ends shown in the illustration were included for appearance as well as to protect the garments against contact with dirt.

LYON *Service*
STORAGE EQUIPMENT
LYON METAL PRODUCTS, INCORPORATED, Aurora, Illinois

LYON METAL PRODUCTS INCORPORATED
1207 River Street, Aurora, Illinois
Please send full details on:
☐ Special $18.75 Wardrobe and Storage Cabinets; ☐ Lyon Steel Shop Boxes; ☐ Showerway; ☐ Storage Survey Service.
Name _____
Address _____
City _____ *State* _____

HOW DO *YOU* FIGURE ... THE COST OF PAINT ? !

BY THE GALLON?
How many square feet will a gallon protect and for how long?

BY THE SQUARE FOOT?
That, too, means little. How long will the paint protect?

BY THE YEAR?
How long the paint will protect—that's the vital point.

BY THE SQUARE-FOOT-YEAR?
The only correct basis, and—

Remember, that records going back many decades have accumulated incontrovertible evidence that Dixon's Industrial Silica Graphite Paint will, in many cases, give complete protection for nine years where formerly three or four years' protection was considered satisfactory.

Severest industrial atmospheres and all climatic influences are long resisted by Dixon's Silica Graphite Paints because of the unique inherent properties of the pigment—natural flake graphite. Chemically inert and moisture repellent, the flat flakes form an unbroken, overlapping armor plating that adheres with remarkable tenacity. As put up in pure boiled linseed oil by the Joseph Dixon Crucible Co., this fine old product yearly adds new friends and laurels.

Fourteen colors, including aluminum

Master Specification BI 44 on request

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JOSEPH DIXON CRUCIBLE CO.

Established 1827 — D X N TRADE MARK — Jersey City, N. J.

DIXON'S INDUSTRIAL SILICA GRAPHITE PAINT

7258

PAGE FENCE

Product of Page Steel & Wire Division, American Chain & Cable Company, Inc.

YOU'RE LOOKING AT A WING CHANNEL FENCE POST!

PAGE pioneered in originating and designing this post especially for chain link fence fabric. It provides even greater strength and utility. This post, a PAGE contribution to better protection, is only one of many exclusive advantages. 56 years of fence service is available through one of our 92 Association Members—a locally responsible firm interested in serving you. Secure his name and free literature—write PAGE FENCE ASSOCIATION, Bridgeport, Conn.

Courtesy of Kinney Mfg. Co.

● prevents end-play

Adjustment of anti-friction bearings on this Kinney Pump is taken care of by Laminum shims. They fit on both shafts, in the ball thrust bearings, and fix the location of the "Heliquad" rotors endwise in the pump casing. Precision adjustment . . . merely by peeling off the .002 in. (or .003 in.) laminations! Write for Laminum sample.

LAMINATED SHIM CO., INC. 21-74 44th Avenue, Long Island City, New York

Cleveland Detroit Milwaukee

932

LAMINUM
Precision adjustment **SHIMS**

A high illumination level is produced economically in this machine shop with General Electric Type H MAZDA *Lamps.*

PROFITABLE PRODUCTION TOOLS

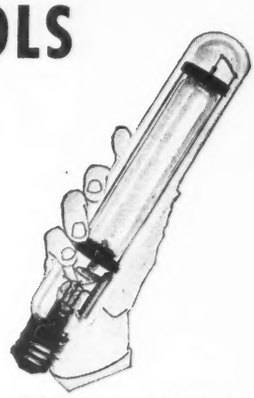
... type H MAZDA lamps

EXECUTIVES know that efficient production is the key to successful business. They buy lighting as any other production tool—on its ability to produce more profits.

GOOD SEEING is a prerequisite to good workmanship—it aids accuracy by relieving the nervous tension associated with eye fatigue.

TYPE H MAZDA Lamps are profitable production tools. They make it easy to obtain the higher illuminations which promote greater eye comfort and increase clarity of fine detail.

WRITE for complete facts on the modern General Electric Type H MAZDA Lamps.



Order your auxiliary devices which were designed especially for this lamp from the General Electric Vapor Lamp Company.

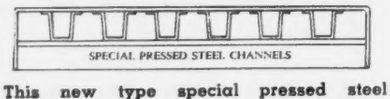
GENERAL ELECTRIC

954H

General Electric Vapor Lamp Co.
815 Adams Street, Hoboken, N. J.

Incandescent Lamp Department
Dept. 165, Nela Park, Cleveland, Ohio

HERE'S NEW TRUCK CONSTRUCTION THAT SAVES YOU MONEY



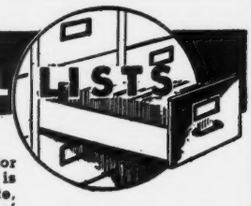
This new type special pressed steel channel prevents deck sag—provides weight savings as much as 30%—all the advantages of steel and none of the disadvantages — savings in truck costs which are comparable to wood—a lifetime of service — stronger construction in every respect.

Get the facts now

about these trucks and platforms . . . and Clark Lift Jacks! You will save floor space, man time and energy with these compact, fast acting Jacks. Complete specifications on request. Let us tell you about our equipment on trial plan.

ALL STEEL WELDED TRUCK CORP.
Railroad Ave. & Eighth St., Rockford, Illinois

McGRAW-HILL
DIRECT MAIL LISTS



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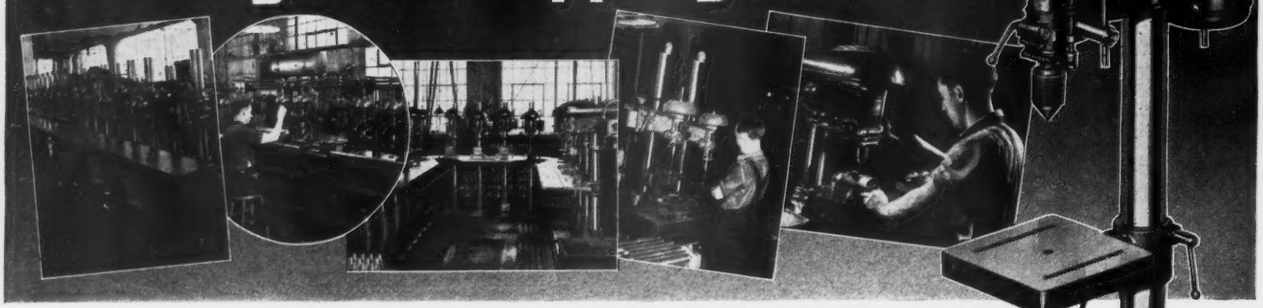
Complete lists covering industry's major markets

LEARN HOW these shops cut Drilling and Tapping Costs



Installations of Delta low-cost drill presses are revolutionizing production methods in thousands of shops all over the country. They are saving time and cutting labor costs because of their: *Initial Low-Cost*—Delta drill presses cost as little as $25.95 yet they out-perform heavier, more expensive machines; *Low Operating Cost*—they use relatively smaller motors; *Low Maintenance Cost*—due to trouble-free design, sealed-for-life bearings; *Greater Flexibility*—they can be adapted for special jobs or built into special drilling units at considerable savings; *Portability*—they can be easily moved around for economical setups and placed beside operators to fill in "waiting time." These are only a FEW of the reasons why Delta Tools are making over plant production methods.

No. 970
14" floor type drill press including V-Belt and Motor Pulley but without motor or switch
$38.35

SEND FOR THIS DRILL PRESS BOOK

Send for Drill Press Book
—giving complete specifications, prices and technical data on the entire line of Delta 11", 14" and 17" Drill Presses. Mail the coupon today.

Delta Mfg. Co., (Industrial Division)
625 E. Vienna Ave., Milwaukee, Wis.

☐ Please send me Special Delta Drill Press Book.

☐ Please send me complete Catalog of Delta low-cost tools.

Name .....

Address .....

City .....State.....

DELTA MANUFACTURING COMPANY
625 E. Vienna Ave., Milwaukee, Wis.

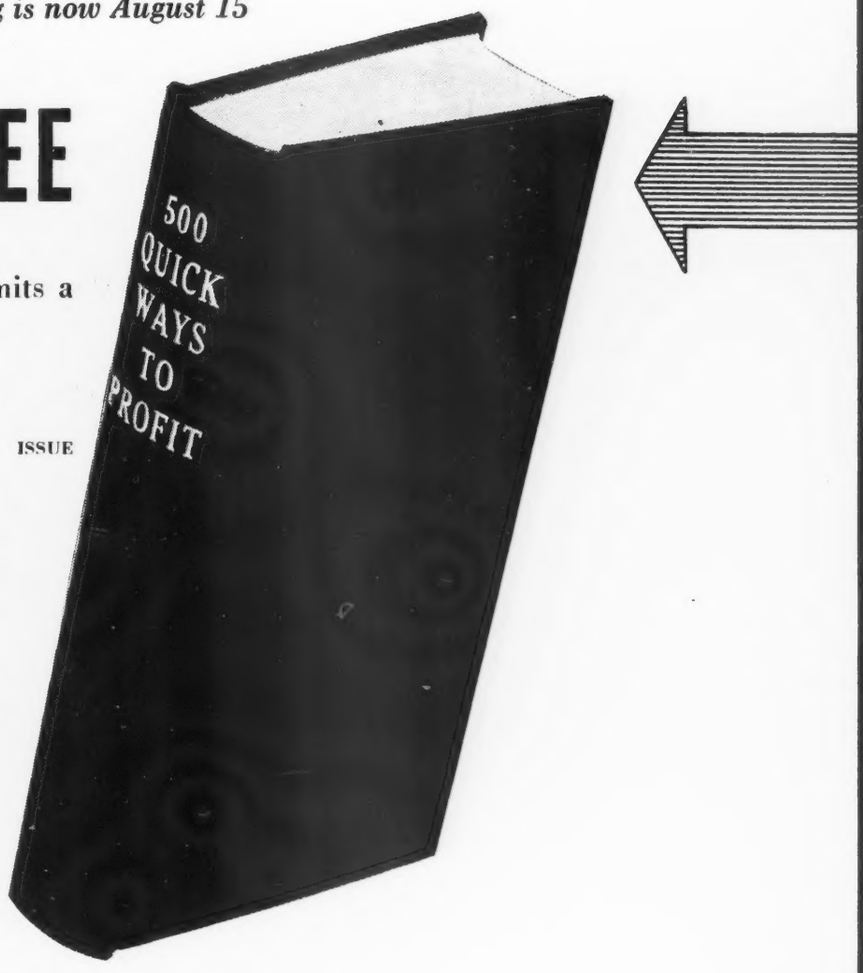
Time Extension on Contest: *Date for mailing entries has been extended 30 days. Last date for mailing is now August 15*

THIS BOOK FREE

. . . . to each person who submits a cost-cutting article for FACTORY'S

SECOND ANNUAL **QUICK WAYS TO PROFITS** ISSUE

to be published in November



Let us know now, on one of the reply cards below, that you will submit a cost-cutting article. As quickly as possible send in the article (or as many as you like). To each person submitting one or more we will mail, free of charge, a copy of "500 Quick Ways to Profits," a pocket size book with stiff covers containing every one of the 500 quick ways published in our November issue of last year.

BULLETIN BOARD ANNOUNCEMENT AVAILABLE: Free, upon request, copies of a 12 x 18 inch Bulletin Board Announcement of this contest, for posting in your plant. Perhaps one of your employees will win a major award. At any rate here is an opportunity to get the people in your plant to think in terms of cost-cutting. Just drop a line to the editor on your letter-head telling how many copies of the bulletin board announcement you want.

See next page for rules. Enter your name now. Use one of the handy reply cards

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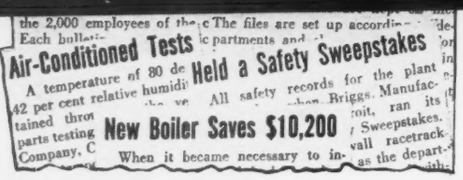

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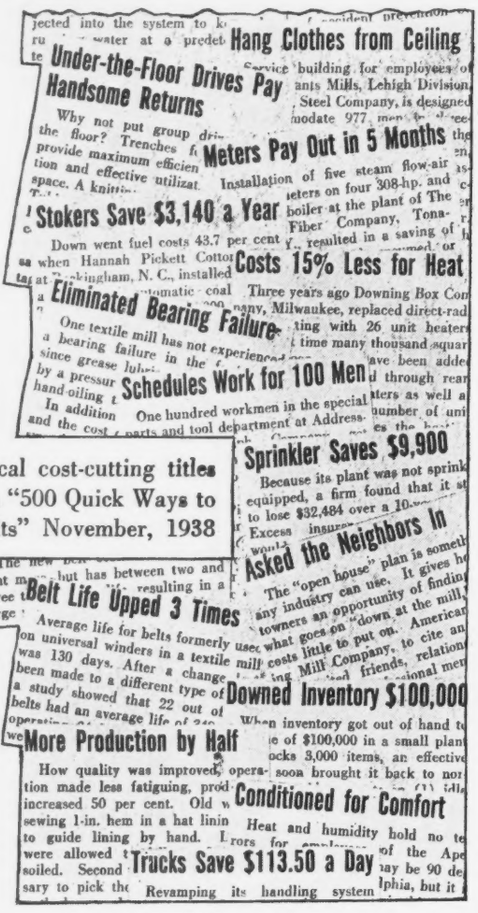
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Also 15 awards of $10 each and 35 awards of $5 each for ideas like these

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1. **Materials Handling, Layout, and Motion Economy**
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RULES

1. You can enter a cost-cutting idea in competition for the *Factory Awards* if you are regularly employed in the manufacturing industries. You don't have to be a subscriber to *Factory*. Your idea may be as short as you like. But it must not exceed 500 words. Send in more than one if you wish.

2. Remember the old Chinese proverb: One picture's as good as 10,000 words. If you have a photograph or a drawing that helps to make your idea clearer, let's have it. But a picture is not essential.

3. Mail contributions not later than August 15, 1939, to L. C. Morrow, Editor, *Factory*, 330 West 42d St., New York, N. Y. Winners of the *Factory Awards* will be announced in an early issue thereafter. Duplicate prizes in case of ties. Judges: L. C. Morrow, Editor; L. K. Urquhart and G. A. Van Brunt, Associate Editors.

4. All material submitted at sender's risk. The editors reserve the right to publish prize-winning ideas, also other ideas accepted and paid for.

If other readers have beaten you to the Business Reply Cards, never mind. Just write us a note saying you want to enter

Yes. I'll send in a Cost-Cutting Idea between now and August 15. Meanwhile enter my name as a contestant for the *Factory Awards*.

Name .....

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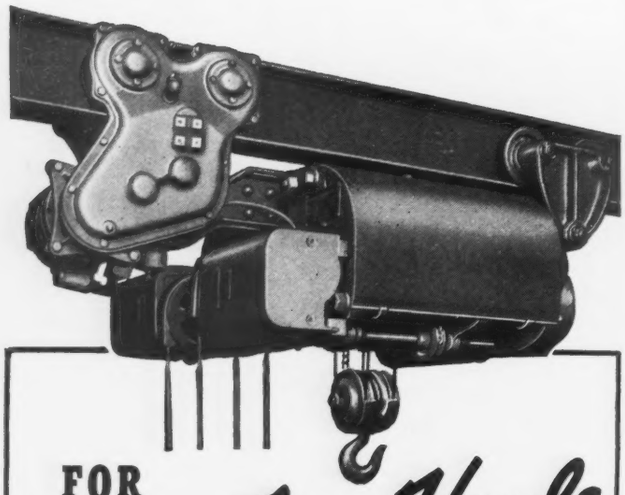

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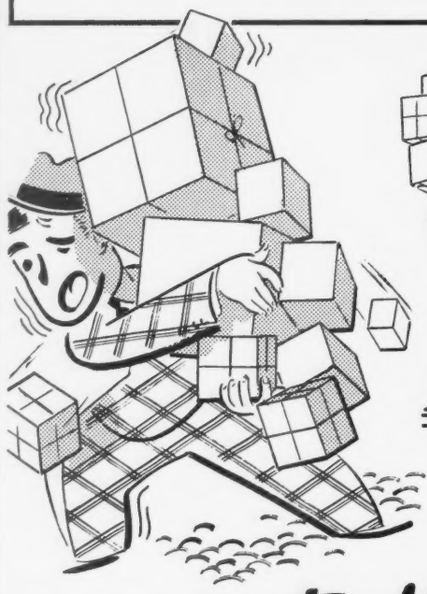

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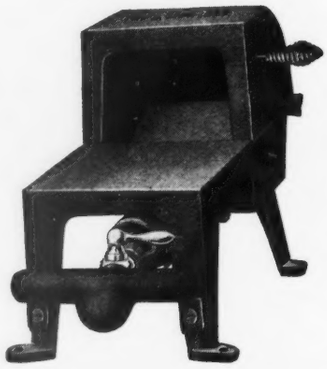

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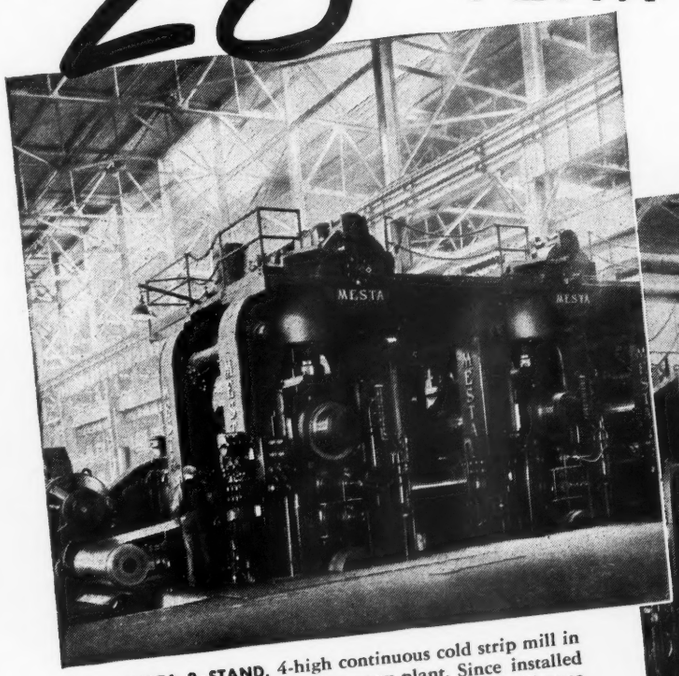

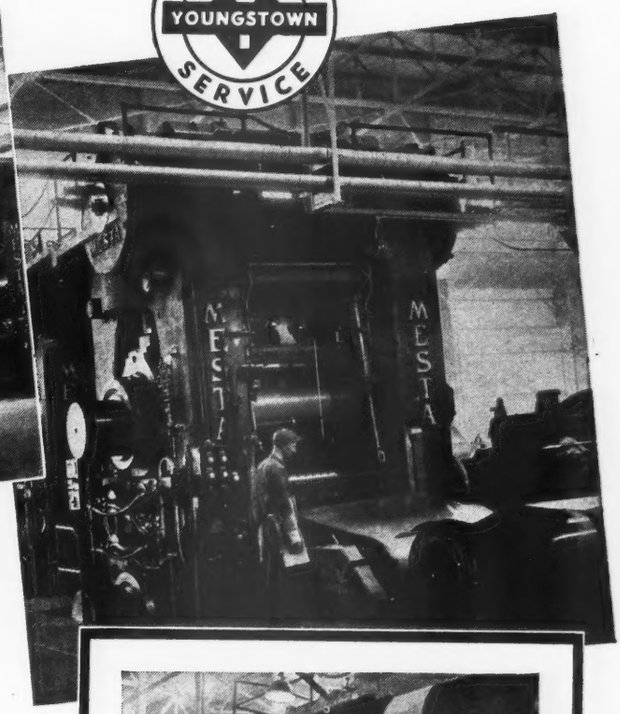

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YOUNGSTOWN S. & T. uses Texaco Regal Oil K to lubricate these mills. It separates readily from water, without the need of special equipment.

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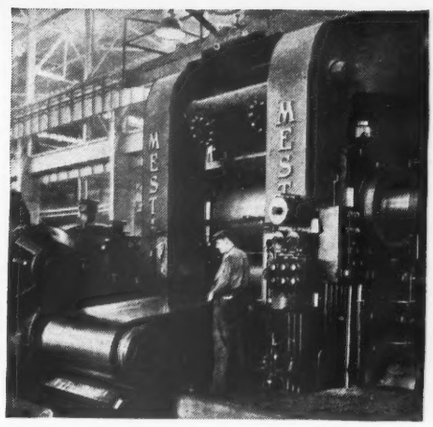
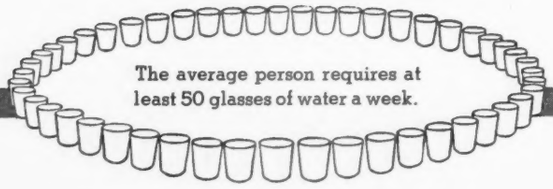


IN THE MOTORS which operate these 54- and 72-inch mills, Youngstown uses Texaco Regal Oil C.

TEXACO REGAL OILS

FOR CIRCULATING LUBRICATION SYSTEMS



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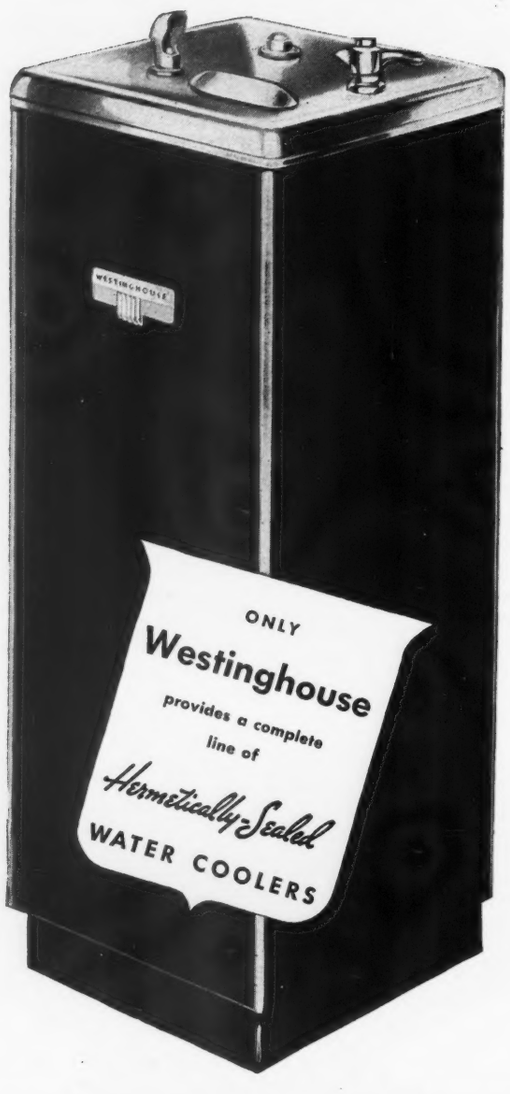

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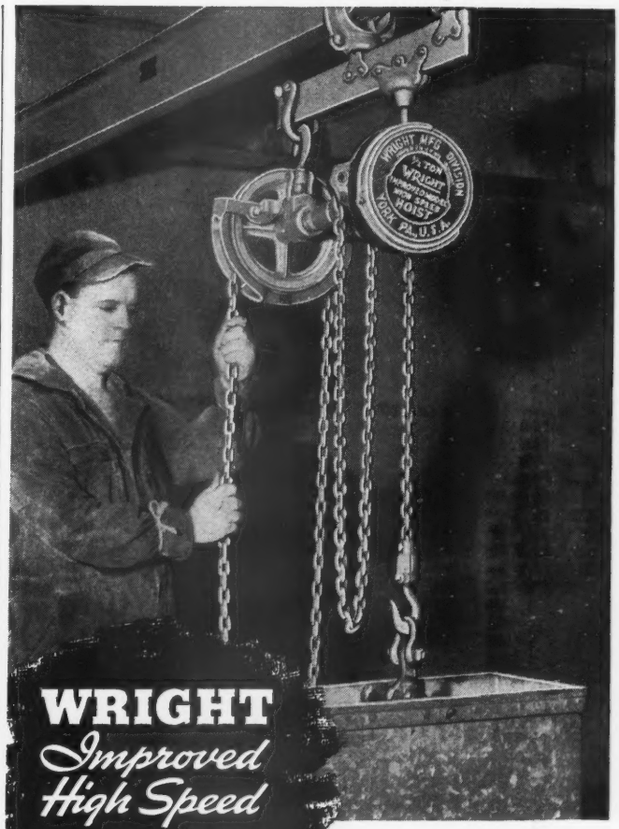

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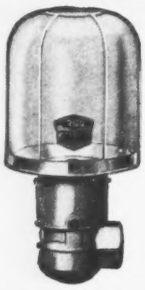

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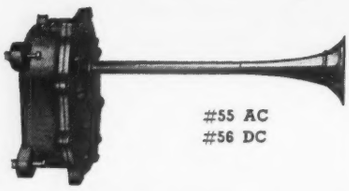

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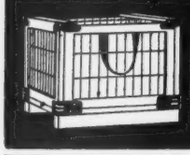

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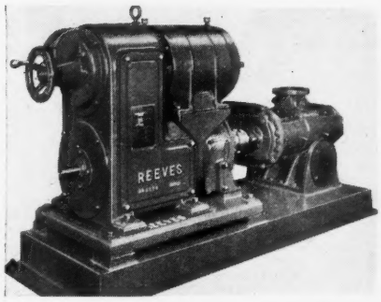
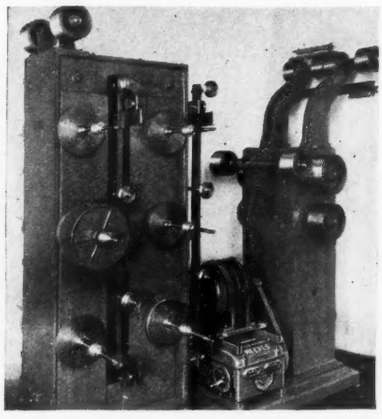


APPLIED TO PUMPS

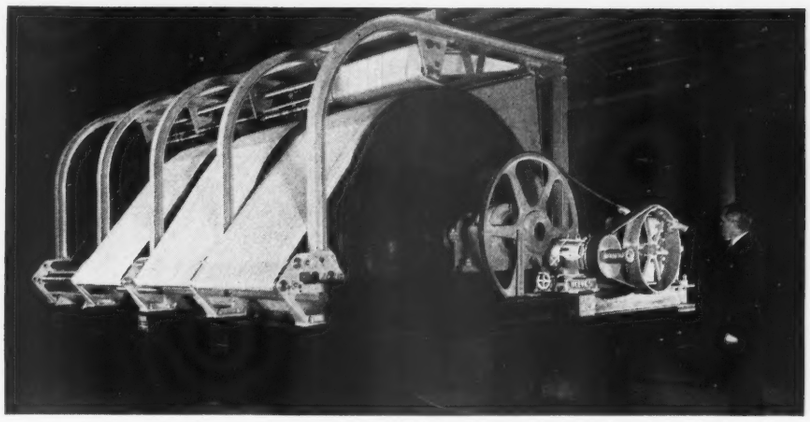
This Northern Pump, now in the plant of a leading corn products refining company, is used for handling a protein solution of water. By turning the handwheel of the **REEVES** Motodrive with which the pump is standardly equipped, varying capacity flow from 10 g.p.m. to 3 g.p.m. is easily and quickly obtained. The Motodrive combines motor, variable speed mechanism and gear reducer in a single unit.



ON WIRE PULL-OUT

This Pull-Out is used to take wire through oven at uniform rate of speed in enameling magnet wire on American Insulating Machinery Co.'s "H-20" Enameling Machine. By driving through a **REEVES** Transmission, speed of Pull-Out can be varied accurately for different wire size and enamels.

SPEED VARIATION ON CORD VACUUM FILTER



Filtering is accomplished through a belt of cords, which runs over a revolving drum, on the recently introduced Louisville-Wright Cord Vacuum Filter. Clogging is eliminated, constant filtration rate secured and a high recovery effected. These filters are designed for use in food product clarification, vegetable carbon decolorization, sewage disposal, brewing, distilling, chemical processes, etc. Infinitely variable drum speed is essential to meet varying conditions of wet materials. To fulfill this requirement Louisville Drying Machinery Company equips this filter with the **REEVES** Vari-Speed Motor Pulley, and any needed drum speed is instantly and accurately available over a 3:1 ratio of speed range.

REEVES ADVANTAGES

● *Positive transmission* of power at any speed and under varying loads; no slippage or fluctuation.

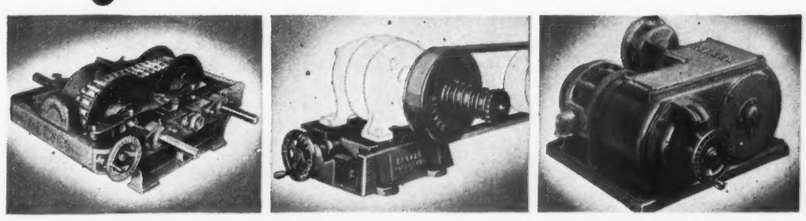
High efficiency . . . negligible loss of power transmitted.

Simplicity of design and operating principle . . . few moving and wearing parts; long life and trouble-free service.

Wide range of designs, sizes, speed ratios, controls . . . insuring the correct application for your individual needs.

A nation-wide engineering organization . . . at your service, without obligation.

THE 3 BASIC UNITS IN MODERN REEVES LINE



REEVES SPEED CONTROL

REEVES PULLEY COMPANY, Department F-69
Columbus, Indiana

Send catalog G-384, describing your complete line of Speed Control equipment and how it is being used in 18,000 industrial plants.

Name..... Dept.....

Company.....

Street..... City.....

SEARCHLIGHT SECTION

EMPLOYMENT : BUSINESS : OPPORTUNITIES : EQUIPMENT—USED or RESALE

UNDISPLAYED RATE:

15 cents a word, minimum $3.00 an insertion.

(See ¶ on Box Numbers)

Positions wanted (full or part-time salaried employment only), ½ the above rates.

Proposals, 40 cents a line an insertion.

INFORMATION:

Box Numbers in care of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.

Discount of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH:

The advertising rate is $8.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞ inch vertically on one column. 3 columns—30 inches—to a page. F.M.M.

Copy for new advertisements must be received by July 20th for the August issue

POSITION VACANT

PRODUCTION MANAGER WANTED by responsible manufacturer. Must have successful experience record with thorough knowledge of all phases of steel cabinet production. Our personnel know of this advertisement. P-574, Factory Management and Maintenance, 520 N. Michigan Ave., Chicago, Ill.

EMPLOYMENT SERVICE

EXECUTIVES AND TECHNICAL MEN. Contact employees for positions through our confidential and effective methods. We negotiate preliminary overtures. Established 24 years. Inquiries invited. H. H. Harrison, Director. The National Business Bourse, 20 West Jackson Blvd., Chicago.

POSITIONS WANTED

YOUNG ENGINEERING GRADUATE June 1939. Industrial Major. Desires position of any kind. Willing to accept small salary in exchange for experience. Location open. PW-575, Factory Management and Maintenance, 330 W. 42nd St., New York, N. Y.

COST REDUCTION ENGINEER — young, ingenious inventive, thorough, executive training, excellent record. Experienced in all departments of manufacture of light and heavy machinery. Now employed as Manager of Cost Reduction Department. Available as same or Assistant Works Manager. PW-576, Factory Management and Maintenance, 520 N. Michigan Ave., Chicago, Ill.

PLANT MAINTENANCE ENGINEER. Can assume complete responsibility of plant maintenance. Technically trained. Age 31. 10 years experience in plant maintenance consisting of installation, construction and maintenance of A.C. and D.C. Power and light equipment; boiler-room auxiliaries; mechanical equipment; all kinds of piping; electrical and mechanical industrial instruments and controls; and general building maintenance. PW-577, Factory Management and Maintenance, 520 N. Michigan Ave., Chicago, Ill.

WANTED

ANYTHING within reason that is wanted in the field served by Factory Management and Maintenance can be quickly located through bringing it to the attention of thousands of men whose interest is assured because this is the business paper they read.

REPRESENTATIVES WANTED

To sell Wiping Waste and Wiping Cloths in Eastern States on commission. A good sideline for men selling Mill Supplies, Lubricating Oils, Belting, etc., to the Industrial Trade. Write:

UNION WASTE COMPANY, INC.
2306 N. American Street, Phila. Pa.

SALARIED POSITIONS

$2,500 to $25,000

This thoroughly organized advertising service of 29 years' recognized standing and reputation carries on preliminary negotiations for positions of the caliber indicated above, through a proceduce individualized to each client's personal requirements. Several weeks are required to negotiate and each individual must finance the moderate cost of his own campaign. Retaining fee protected by a refund provision as stipulated in our agreement. Identity is covered and, if employed, present position protected. If your salary has been $2,500 or more, send only name and address for details.

R. W. BIXBY, INC.
276 Delward Bldg., Buffalo, N. Y.

—TRANSFORMERS—

A Complete Stock **Prompt Shipment**

6—500 KVA Pittsburgh Transformers 25200/23800/22600-2300/4000Y volts..... **$1025.00** Each

We Rewind, Repair and Redesign all Makes and Sizes
ALL TRANSFORMERS GUARANTEED FOR ONE YEAR
Write for Catalog No. 134D

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1912 CINCINNATI, OHIO

RE-NU-BILT MOTORS GENERATORS TRANSFORMERS LARGE & HEAVY ELECTRIC POWER EQUIPMENT

Thoroughly Tested Before Shipment *and* Guaranteed

RE-NU-BILT BELYEA MOTORS

MORE THAN 50% SAVING

BELYEA CO. INC.
35 HOWELL STREET
JERSEY CITY, NEW JERSEY

ELECTRICAL MACHINERY

Motors and Generators, A.C. and D.C. for sale at Attractive Prices. Large stock. New and Rebuilt. All Guaranteed. *Write for Stock List and Prices.*

V. M. NUSSBAUM & CO.
FORT WAYNE, IND.

FOR SALE
ADJUSTABLE SPEED MOTOR

1—Single motor drive, 250 volts, D.C., 100 H.P., variable voltage, 300 to 900 R.P.M. motor complete with controls. Synchronous motor (440 volts) generator set. Installed in 1932.

Details and list of other motors and equipment sent on request.

FS-578, Factory Management and Maintenance
520 No. Michigan Ave., Chicago, Ill.

RECEIVER'S
AUCTION

By order Pullman & Comley, Attys.

This modern clean, well-preserved factory containing 18,000 square feet of floor space; 1481 Seaview Ave., Bridgeport; in the heart of the industrial capital of Connecticut; 545 feet Bridgeport Harbor channel frontage; Property valued at $65,000, adjacent New Haven R.R.; Ideal for light industry, spirits or petroleum distributor. Sale takes place on premises Tues., July 18, at 11 A.M. Write for illustrated booklet.

THE GERTH CO.
AUCTIONEERS—HARTFORD, CONN.
955 Main St., Bridgeport Phone 5-6440

MODERN PRODUCTION METHODS

require capable men trained in cost reduction and methods improvement techniques. Industry is demanding trained Methods Engineers who are specialists in work simplification and motion and time study procedures to reduce costs and increase productivity and quality. Fitting men for such responsible positions in industry is accomplished by popular home training courses in Methods Engineering compiled and offered by the staff engineers of the

METHODS ENGINEERING COUNCIL
Industrial Training Division
Wood and Franklin Streets
PITTSBURGH, (21), PENNSYLVANIA

Send now for free booklet describing in detail all our popular home training courses.

"SEARCHLIGHT" IS

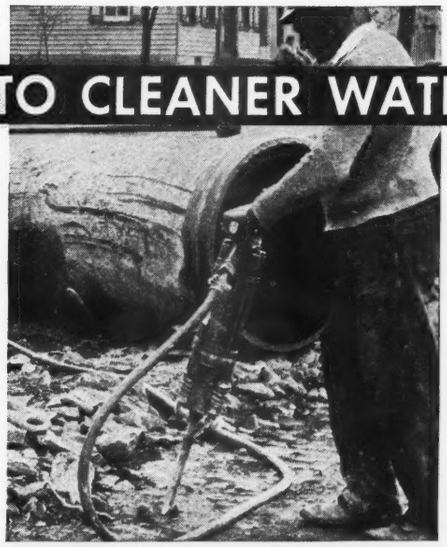
Opportunity Advertising

—to help you get what you want.

—to help you sell what you no longer need.

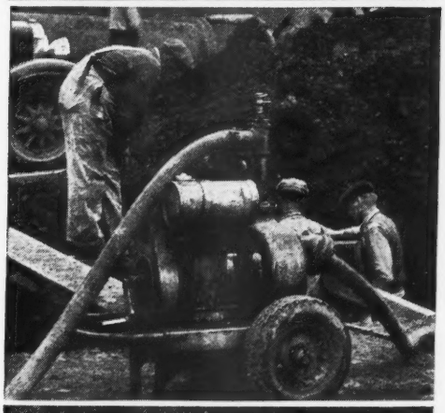
Take Advantage Of It
For Every Business Want
"Think SEARCHLIGHT First"

3 STEPS TO CLEANER WATER FOR READING, PA.



1

Thermoid Air Hose, operating under 90 lbs. pressure, is used on pneumatic drills to break up the paving and expose the mains.



2

Thermoid Suction and Discharge Hose is used to drain the trenches in which the water mains are located. The hose illustrated carries 18,000 gallons of water per hour . . . pump capacity. It was formerly used successfully on a 25,000 gallon pump.

3

Thermoid Air Hose is used to run the revolving wire brush used in cleaning the inside of the main . . . a fifty year accumulation. In spite of abrasion from rocks and timber, this hose shows substantially no wear after six months of severe daily use.

OF COURSE THE HOSE IS THERMOID

Soon the water supply in Reading, Pa., will be purer and more palatable, for a man-sized job of water main cleaning and relocating has been undertaken there.

The speed and economy of this work will be traceable in no small measure to the part that Thermoid Hose is playing. Thermoid Hose is not only contributing to peak operation . . . but, because of its efficiency, has eliminated needless shut-downs.

There's no real secret to Thermoid's consistently superior performance. It lies in a closely followed policy that includes: *First,* product development based upon practical engineering knowledge. *Second,* the use of only the finest raw materials. *Third,* fabrication by the most advanced manufacturing methods.

Such a policy assures every Thermoid Product's being best suited for its particular purpose . . . assures its giving long life and economical operation.

Regardless of your industrial rubber product needs, it will pay you to investigate fully Thermoid's records of performance. The low initial costs of Thermoid Products, and their assured efficiency are bound to effect real savings.

More than half a century of progressive engineering and product development.

Thermoid
INDUSTRIAL RUBBER PRODUCTS

THERMOID RUBBER, DIVISION OF THERMOID COMPANY, TRENTON, N. J.

Standard types of belting made by Thermoid:
Transmission Belting
Conveyor Belting
Multiple V Belts
Grader Belting
Canners' Belting
Bucket Elevator Belting

Thermoid

Standard types of hose made by Thermoid:
Air Hose
Water Hose
Steam Hose
Tank Truck Hose
Gasoline Hose
Suction Hose

BELTING · HOSE · PACKINGS · BRAKE LININGS

INDEX TO ADVERTISEMENTS

	Page
Abrasive Products, Inc.	116
Acheson Colloids Corp.	130
Acme Steel Company	149
Alemite Div. Stewart-Warner Corp.	29
Allen, Oliver Field	190
Allen-Bradley Co.	insert, 153, 154
Allis-Chalmers Mfg. Co	insert, 19, 20, 105
All Steel Welded Truck Corp.	180
Aluminum Co. of America	136
American Air Filter Co.	175
American Chain & Cable Co., Inc.	187
American Engrg. Co.	182
Amer. Hot Dip Galvanizers Ass'n.	181
American Monorail Co.	158
American Pulley Co.	173
Automatic Transportation Co.	25
Bakelite Corp.	147
Baker-Raulang Co.	140
Baldwin-Duckworth Chain Corp.	121
Barrett Co.	183
Bassick Co.	189
Benjamin Electric Co.	32
Blaw-Knox Co.	164
Boston Woven Hose & Rubber Co.	22, 23
Browning Crane & Shovel Co.	142
Buffalo Forge Co.	161
Bull Dog Electric Prod. Co.	35
Bunting Brass & Bronze Co.	165
Byers Co., A. M.	2nd Cover
Carey Co., Philip	162
Carrier Corp.	119
Century Electric Co.	163
Chisholm-Moore Hoist Corp.	108
Clarage Fan Co.	168
Clark Controller Co.	125
Colson Corp.	142
Crane Co.	141
Cyclone Fence Co.	160
Darnell Corp., Ltd.	170
Delco Products Div. G. M.	195
Delta Mfg. Co.	180
De Vilbiss Co.	112
Disston & Sons, Inc., Henry	109
Dixon Crucible Co., Jos.	168, 178
Ducommun Co., M.	190
du Pont de Nemours & Co., E. I.	184
Eagle-Picher Lead Co.	182
Electric Controller & Mfg. Co.	132
Electric Storage Battery Co.	101
Electric Wheel Co.	170
Elwell-Parker Electric Co.	129
Fairbanks Co.	184
Fairbanks, Morse & Co.	34
Faultless Caster Corp.	110
Federal Electric Co.	190
Felters Co.	155
Finnell System, Inc.	174
General Electric Co.	26, 103, 166
G. E. Vapor Lamp Co.	179
Goodrich Company, B. F.	3, 115
Goodyear Tire & Rubber Co.	33
Graybar Electric Company	7
Grinnell Co.	113
Gulf Oil Corp.	6
Harnischfeger Corp.	134, 139
Harrison Radiator Div. G. M. Corp.	143
Hough Shade Corp.	148
Hyatt Bearings Liv. G. M. Corp.	107
Industrial Brownhoist Corp.	170
Industrial Control Div. of Square D	3rd Cover
Inland Steel Co.	138
International Harvester Co.	131
Invincible Vacuum Cleaner Mfg. Co.	124
Johnson Gas Appliance Co.	184
Jones & Laughlin Steel Corp.	159
Kidde & Co., Inc., Walter	122
Koppers Co.	insert, 135
Korfund Co.	162
Laminated Shim Co.	178
Lamson Co.	133
Lewis Co., G. B.	190
Lincoln Engineering Co.	150
Link-Belt Co.	4, 196
Logan Co., Inc.	166
Lux Fire Extinguishers	122
Lyon Metal Products, Inc.	177
Macwhyte Co.	167
Manhattan Rubber Mfg. Div. Raybestos-Manhattan, Inc.	27
Manheim Mfg. & Belting Co.	126
Master Electric Co.	31
McCaskey Register Co.	30
McGraw-Hill Book Co.	156
Medart Co.	145
Mercury Mfg. Co.	152
Methods Engrg. Council, Inc.	190
Mogensen, Allan H.	190
Morton Salt Co.	146
Municipal Advtg. Bd., Pensacola, Fla.	168
Nat'l Machine Tool Builders Ass'n.	8
New Departure Div. G. M. Corp.	36
Nitrose Co.	174
North Bros. Mfg. Co.	120
Northern Engrg. Works	164
Osborn Mfg. Co.	9
Owens-Illinois Glass Co.	28
Page Fence Ass'n.	178
Philadelphia Gear Works	157
Pittsburgh-Corning Corp.	151
Pure Oil Co.	190
Reeves Pulley Co.	191
Republic Steel Corp.	10, 11
Rhoads & Sons, J. E.	176
Rockbestos Products Corp.	18
Roper Corp., George D.	156
Ross Engrg. Corp., J. O.	126
Ruberoid Co.	21
Ryerson & Son, Inc., Jos. T.	128
Sawyer Electrical Mfg. Co.	152
Schrader's Son, A.	160
Scott Paper Co.	162
Scully Steel Products Co.	137
Searchlight Section	192
Service Recorder Co.	148
Service Section	190
Shafer Bearing Corporation	127
Shell Oil Co., Inc.	111
Shepard Niles Crane & Hoist Corp.	160
SKF Industries, Inc.	24
Socony-Vacuum Oil Co.	12, 13
Square D Company	3rd Cover
Standard Conveyor Co.	169
Standard Oil Co. of Indiana	insert, 117, 118
Standard Pressed Steel Co.	174
Sturtevant Co., B. F.	114
Swartzbaugh Mfg. Co.	176
Texas Company	185
Thermoid Rubber Div. Thermoid Co.	193
Trico Fuse Mfg. Co.	190
U. S. Steel Subsidaries	137, 160
Waldron Corp., John A.	152
Westinghouse Elec. & Mfg. Co.	14, 15, 123
Westinghouse (Refrigeration Div.)	186
Weston Electrical Instrument Corp.	144
Wright Mfg. Div. A. C. C. O., Inc.	187
Yale & Towne Mfg. Co.	16, 17
Young Radiator Co.	166

▼

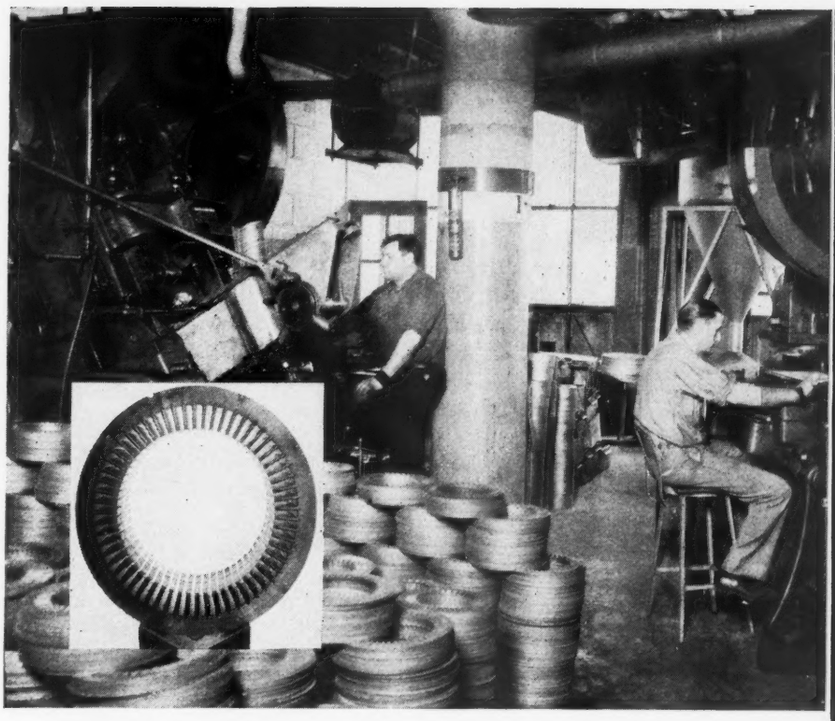
INDUSTRIAL CONSULTANTS.. 190

▼

SEARCHLIGHT SECTION

Classified Advertising

Auction	192
Business Opportunities	192
Employment Service	192
Positions Vacant	192
Positions Wanted	192
Selling Opportunities	192
Equipment New and Used	192
Belyea Co., Inc.	192
Electric Service Co., Inc.	192
Nussbaum & Co., V. M.	192

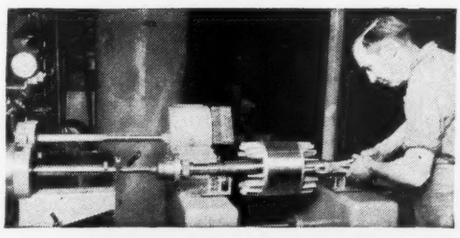


PERFECT TEETH THAT WON'T CHEW
Cores Built to Eliminate Insulation Rupture

To attain the smoothly aligned slots and clean-cut laminations of Delco stators, a multiple-slot die is used in a group operation on all standard types. This method eliminates any inequalities that might cause partial rupture of insulation and eventual wiring failure.

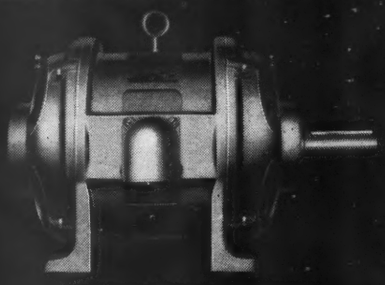
Reinforcing ribs on the slot teeth prevent lamination teeth from fanning out in the stator winding process, and ample space has been allowed in slots for a sufficient quantity of highest quality insulation. In winding, the coil is completely closed to exclude metal particles or dust that might lodge and form a conductor.

Delco cores are made of high-quality electric sheet steel, accurately ground on the outside, concentric with end-frame register. We invite you to investigate their workmanship, and ask you to *look within the motor you specify.*

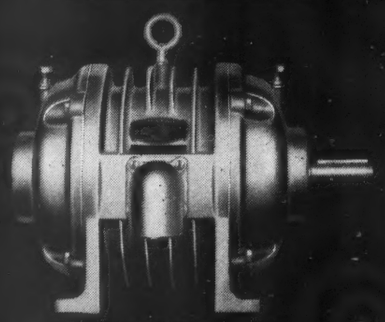


EVERY DELCO MOTOR IS DYNAMICALLY BALANCED

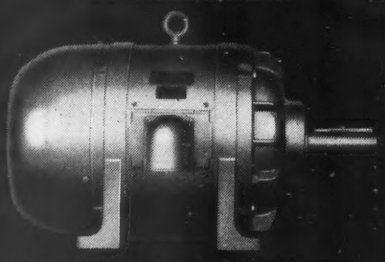
No motor leaves Delco Products that has not been dynamically balanced on a specially-designed balancing machine. Delco balances every motor. Each end of the rotor and shaft is first balanced independently, while the machine indicates exactly how much compensation is required and where it should be applied. After all adjustments have been made, the complete rotating assembly is given a final check. Delco motors assure satisfactory balance.



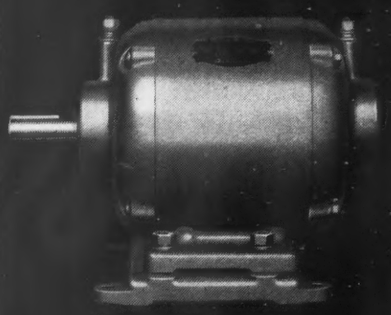
Open Frame, Sleeve or Ball Bearing



Totally Enclosed Ball Bearing



Totally Enclosed Fan-Cooled Ball Bearing



Fractional Horsepower Motor

• • •

Delco industrial AC motors are available in various types, possessing electrical and mechanical characteristics to meet practically every requirement.

Normal starting torque—normal starting current—high starting torque—low starting current—as well as high slip. Each type available in open frame, sleeve or ball bearing—totally enclosed ball bearing—totally enclosed fan-cooled ball bearing—also multi-speed motors. Electrical and mechanical modifications available. Delco motors comply with NEMA standards.

DELCO MOTORS

DELCO PRODUCTS
DAYTON, OHIO

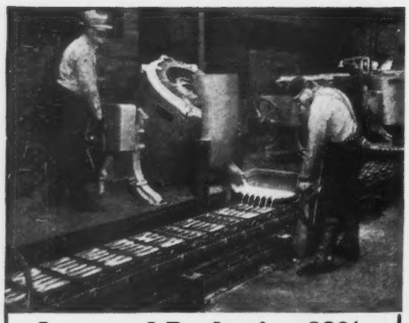
DIVISION OF GENERAL MOTORS CORPORATION

EIGHT EXAMPLES of How Others Cut Costs with LINK-BELT Conveyors

● Link-Belt's broad experience in the art of handling materials from where they are to where they are wanted next, is at your service. No inquiry is too large or too small to merit our painstaking attention. Send for catalog.

LINK-BELT COMPANY 7799

Chicago Philadelphia Indianapolis Atlanta San Francisco Toronto Offices in Principal Cities

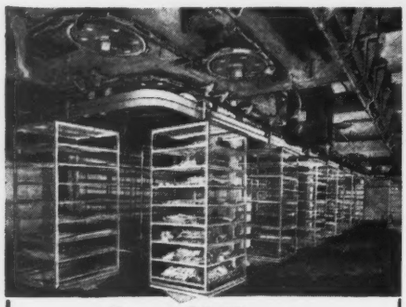


Increased Production 66%

Hand-lifting and carrying ladles to and from the molds has been eliminated by this Link-Belt conveyor which carries the molds through the pouring operation. The ingots are cooled on the conveyor, which can be adjusted to travel at varying speeds to suit production, and are automatically discharged from the molds.

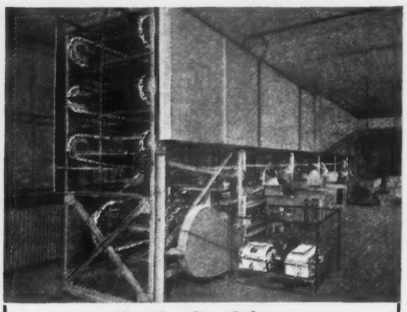
"Continuous Flow" Attained

In the Stewart-Warner Corp. radio plant in Chicago, both manufacture and assembly are controlled by the use of various forms of conveyors—belt, roller, slat and overhead trolley conveyor systems. The "continuous flow" realized, has come to be an important economy factor.



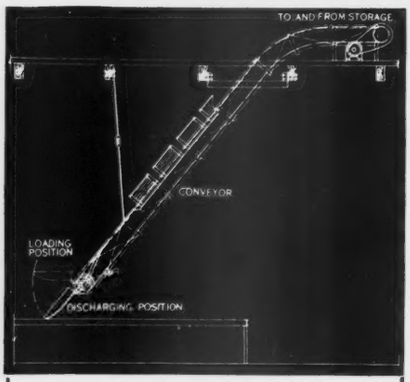
Saves 23 Hours

In a Chicago canning and sausage plant they are now thawing frozen meat in 45 minutes with this Link-Belt overhead conveyor through hot room. It slashes 23 hours off the former thawing period.



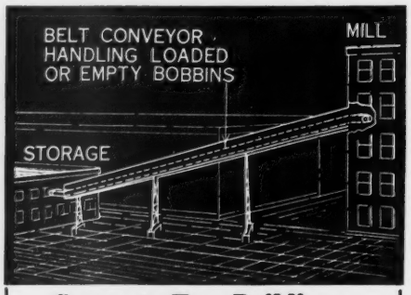
Cools Cookies

In restricted floor space and low headroom, this Link-Belt conveyor cools cookies from 200 degrees to 90 degrees F as they come in rapid succession from the oven at the rate of a ton per hour, for Thinshell Candies, Inc., Chicago. Unlike other apparatus for cooling or drying products in process, it is not a belt conveyor but consists of a suspended type of tray-elevator, conveyor, and lowerer.



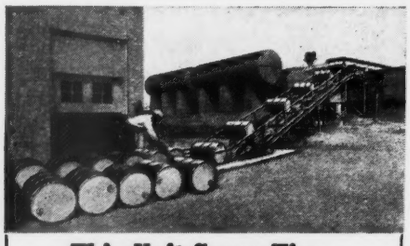
In Confined Quarters

The Mount Carbon Brewery Co. of Pottsville, Pa., installed this inclined booster and lowering conveyor for handling beer cases and cartons, between first and second floors of bottling plant. This application shows that conveyors can often be installed in places where the owner least suspects, that confined quarters are not often a handicap, and that they can be used to handle materials or products with appreciable savings.



Connects Two Buildings

This enclosed belt conveyor, illustrated, solved a mechanical handling problem with which a textile mill was confronted. It carries boxes of yarn on bobbins between two buildings and returns empties.



This Unit Saves Time

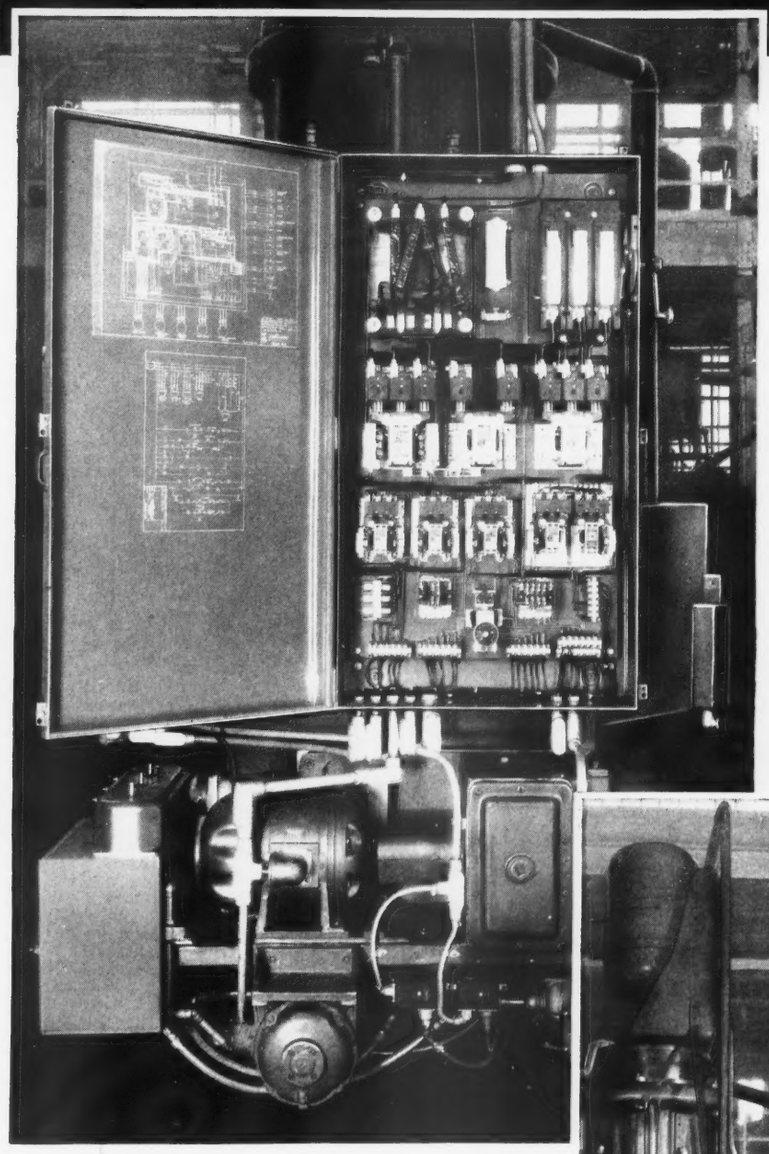
The Howard Flint Ink Co. in Detroit, had a problem of transporting heavy steel drums of ink from the shipping room door to a loading platform 90-ft. away. This Link-Belt conveyor solved the problems of distance, obstructions, weight and cost.

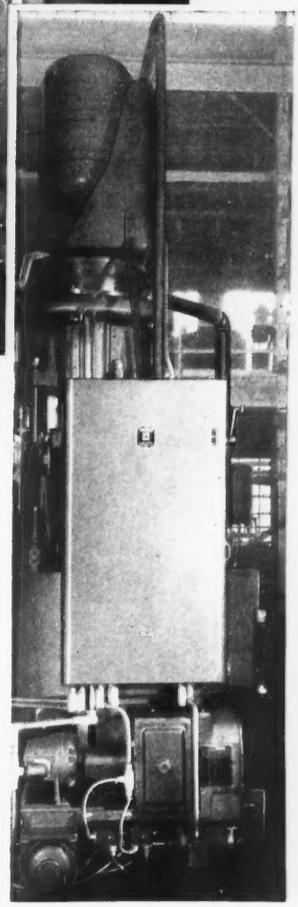
Reduces Packaging Costs

"Cynthia Sweets" are now packaged on Link-Belt conveyors. The work is done faster, in a more orderly way, and at less cost. Two simple flat-belt conveyors, one on each side of packing table, are used.

FOR AUTOMATIC MOTOR CONTROL

Rely on





Specialized machine tools for high speed production require the best of automatic electric motor control. This Contin-U-Matic chucking and turning machine is operated by five motors. Each must be controlled to perform its duties in the automatic production cycle—reliably, safely and in proper sequence.

The Square D control panel is built from standard vertically operated automatic starters and magnetic contactors. They automatically start, stop and reverse the motors. Square D pressure switches control the oil lines for hydraulic chucking and forced lubrication.

This panel contains three sizes of automatic starters, all of uniform design and individually mounted on steel plates; an economical, compact, neat assembly.

Square D engineers are experienced in the design of special machine tool control. They are glad to cooperate with machinery manufacturers and machine users in solving motor control problems.

CALL IN A SQUARE D MAN

SQUARE D COMPANY

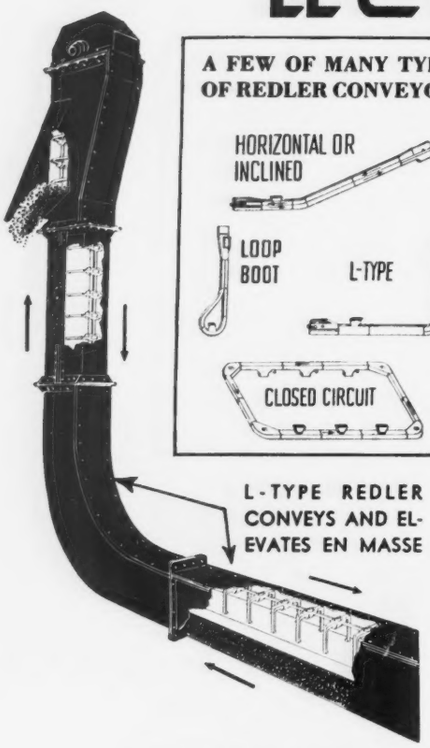
DETROIT - MILWAUKEE - LOS ANGELES

IN CANADA: SQUARE D COMPANY CANADA LIMITED, TORONTO, ONTARIO

CLEAN · SAFE · INEXPENSIVE

Handle Bulk Materials In

REDLER CONVEYOR-ELEVATORS



MOVE BULK MATERIAL EN MASSE IN SOLID COLUMN—REDLERS *convey-elevate bulk materials in a solid column, in a single, compact casing,* without the use of belts, buckets or solid flights.

CONVEY IN ANY DIRECTION—You can convey *any pulverized, granular or small lump material* in any direction in REDLERS. En masse handling prevents breakage of conveyed material.

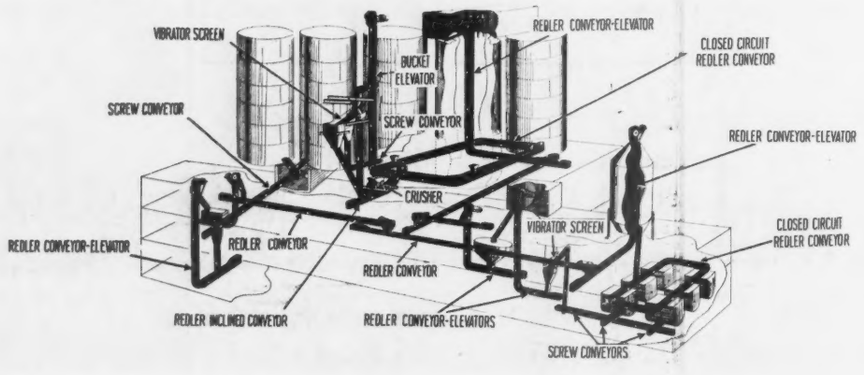
DUST-TIGHT, PREVENT EXPLOSIONS—REDLERS prevent explosions in three ways: First, the *en masse conveying action* does not agitate material, thereby preventing formation of dust. Second, *sealed construction* prevents leakage of dust particles. Third, construction of casing *eliminates most of the air space* which might create an explosive mixture.

AVOID CONTAMINATION—The self-cleaning method of conveying and elevating prevents infestation . . . insuring absolute cleanliness in handling foods, grain, etc.

1 REDLER DOES THE WORK OF 4 OLD STYLE CONVEYORS—A single L-type REDLER Conveyor-Elevator does the work of both a conveyor and an elevator. A horizontal or vertical Closed Circuit REDLER does the work of four old style units.

WRITE FOR REDLER CATALOG NO. 42 NOW!

REDLER CONVEYOR-ELEVATORS HANDLING SOY BEANS



This entire REDLER installation is now in operation in one of our nation's leading industrial plants, handling soy beans used in the manufacture of oils for the paint industry.

Conveying • Elevating • Screening • Transmission Equipment

STEPHENS-ADAMSON MFG. CO.

1 RIDGEWAY AVENUE

LOS ANGELES, CAL. AURORA, ILLINOIS BELLEVILLE, ONTARIO.